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The ELECTRICAL REVIEW

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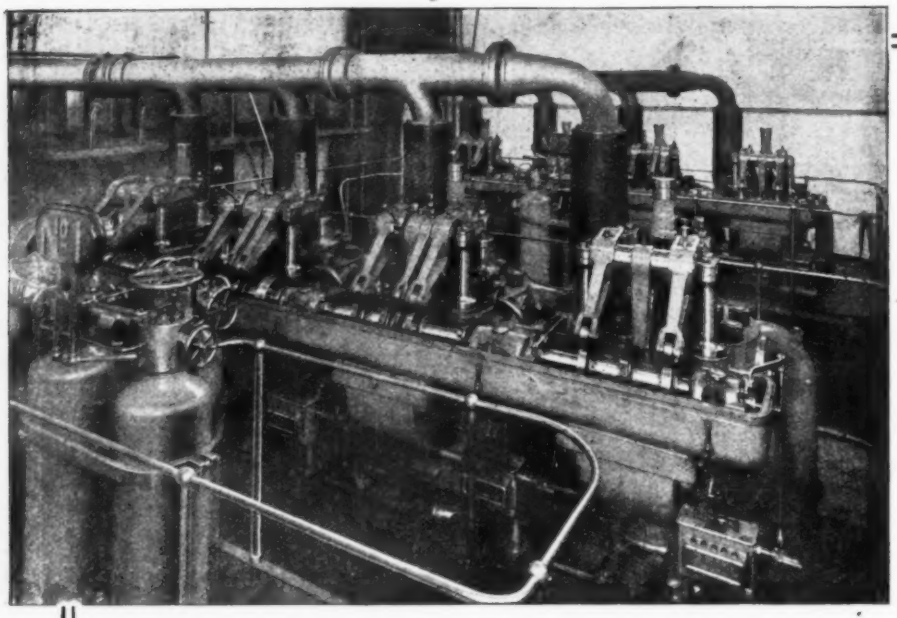

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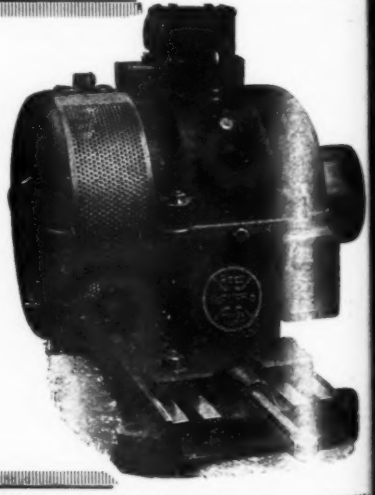

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Electrical Review

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The Problems of Industry.

NINE years ago there was initiated in London a movement to establish an Institute of Industry and Science. It occupied the minds of most leaders of thought who saw the need for chaos to give place to order, organisation, and concentration.

Some of our readers will recall that we devoted much space to the successive stages of the development of the movement. At one of those stages the reference to Science was eliminated from the title, and subsequently, partly by a process of amalgamation, the Institute of Industry became metamorphosed into the Federation of British Industries. The achievements that lie to the credit of that organisation as a representative body in investigating industrial problems, in authoritatively voicing the views of British industry, in advancing constructive propositions, and in giving advisory assistance in Government quarters, have been of incalculable value. Looking backward one can therefore regard with equanimity the troublesome period of travail from which the movement ultimately emerged.

All-embracing as was the original programme, it was thought that there was room for other movements to be developed simultaneously which, while they, too, aimed at assisting toward a solution of some of the immense industrial problems, selected a particular sectional activity; so it came about that we had various leagues, alliances, circles, and so forth for study, investigation, and propaganda purposes. These in their turn passed through the process of metamorphosis; no doubt they served their purpose, contributing an influence needed at the time, and having had their day have all but ceased to be. The Federation and the associations affiliated to it, however, continue as indispensable parts of our industrial life, but it may be that they are regarded as standing exclusively for the manufacturers who are only one of the parties interested in industrial problems.

While we have succeeded in securing a greater respect for science in industry and have certainly attained to a higher degree of efficiency in organisation, most of the old problems of industry still remain with us; indeed, some of them have become accentuated instead of being removed, and new ones have arisen. In short, we may say that the problem of our industrial life, though it has undergone kaleidoscopic changes during the nine years alluded to, has *only been altered*—it has not been actually lessened, it is as serious as it ever

was; indeed, the toughness of the unemployment difficulty is evidence of its complexity. Yet there has been, as we say, no lack of study, no want of ability, and no want of sincerity; if there has been any human deficiency it has been due to failure to secure co-ordination of inquiry and the concentration of the strong will of all classes upon harmonious, unselfish, and profoundly sincere conference with the determination that if the mind of man could find a way out they would discover it.

We have listened for years now to appeals for an industrial truce, a period of real Peace in Industry. All sorts and conditions of public men have been credited with the origination of the idea that this was our crying need and that therein lay the most promising of all the prescriptions for the cure of unemployment and the return of British industrial supremacy and commercial competitive ability. But public aspirations and speeches have not charmed away the disaffection of which disputes are made, nor have they removed the difficulties of those in receipt of low wages, and as far as can be seen at the moment the prophets who predicted that only after passing through the dark experiences of sheer economic necessity should we emerge into prosperity, look like being justified.

The latest and most powerful appeal for Peace emanated from the leading statesman of the British Empire, Mr. Baldwin, whose utterance once more gave the subject emphasis and wide currency. But, good as appeals are, something more is needed. This was the feeling of the Government which set up the Balfour Committee on British Industry and Commerce. Investigation of practically every conceivable aspect of our industrial problems has been proceeding there for some time past. Evidence by all the different interests acquainted with production and with commerce is being brought together in great detail. How vast and varied are its studies was indicated at some length in the ELECTRICAL REVIEW for February 6th, 1925. Feeling that a large part of its problems are such as can only be effectively handled by those possessed by practical knowledge and experience with the actual work of production as carried on in present-day factories, we published an exhaustive serial article by an expert authority in November and December last under the title "Increased Production—Decreased Unemployment." There were advanced therein "suggestions to the Balfour Committee and to the great industries of the country." We should like to feel that the Balfour Committee was the one source to which to look for a complete statement of the problem and the remedies suggested by reliable students, for we have seen so much of duplication and wasteful overlapping which yield divergent views and carry us "no forrader."

We recognise, however, that changing conditions will always produce men who believe that the only way in which to solve our problems is to form some new institute, or society, or organisation. It is a natural disposition, after discussing a matter which we cannot settle off-hand, to say: "Let's form a committee!" Years ago the Institute of Industry established to solve our problems gave way before the F.B.I. It sacrificed its name, its secretary resigned, and eventually the Institute sacrificed itself in order that there might be consolidation of interests, and what Mr. Dudley Docker described as "a sort of Industrial Parliament" the F.B.I. became an accomplished fact.

To-day we have before us a prospectus and memorandum of "The Industrial Institute," which has been formed "for the study of the fundamental problems of industry." We should like to wish the organisation as successful a career as has been attained by the Federation, but does it not seem rather late in the day to establish one more organisation for the study of our problems? Are we not satiated with information, and have we not become over-gloomy through too much study? Have we not sufficient machinery at work already busily collecting data and views respecting things "as they are" without setting up another collecting agency to study those fundamental problems which we have been studying to the death for years?

We print a note of the objects of the new Institute on another page, together with a reference to a Memorandum that was issued last week by a group of its members. The provisional first council is to consist of representative men associated with statesmanship, industry (production, distribution, and finance), the consumers, science, philosophy, and religion. These, while representing group interests, are to approach all subjects in an "attitude" of "inquiry." They will, of course, set aside, as far as is humanly possible, their own preconceptions or predilections, otherwise from experience gained in these pages, when we have referred to Christian principles and industry, we imagine that they will go on talking until doomsday. Having studied things as they are, they will, by the light of knowledge so gained, form conclusions "which may be put into practice and tend toward improvement of the conditions of industrial life." Many of the ideals advanced by visionaries are excellent—as ideals—but they do not help when you try to get down to what is really practicable. There are some things that cannot possibly be understood by a mixed body of students, they being essentially matters for the expert mind, and, after all, however zealously and efficiently such a body may investigate, and however accurate may be the recommendations arrived at, it *must* rest with the industries themselves to decide what is or is not workable. Then, further, many things that are practicable are not economically sound. We note that the lengthy list of vice-presidents includes the name of the president of the F.B.I., and those of its Director and Deputy Director appear among the Members of Council, so that the Institute evidently receives the support of the Federation. This is all to the good considered from the standpoint of practicability and economic soundness.

It will be observed from the memorandum that one of the points referred to by the group is the proposed regulation of production—"balanced industrial development"—in order to render employment in given industries less subject to interruption. This is a subject of real interest and one which has not been lost sight of by ourselves and other students. Those who can throw light upon it and reach "conclusions" that can be put successfully "into practice" within our time will confer a boon on our industrial workers, but they will require to bring experienced, almost specialised, minds to bear upon it if they are to do any good.

The purpose of the Institute plan is excellent, and we hope that it may achieve something. It is obviously not the expectation of its promoters that it shall be immediately effective, and we find it difficult to work up enthusiasm for any new organisation of the kind formed now to inquire into subjects which have been exercising so many minds for so long a time.

We incline to the view of Sir Lynden Macassey that experience has taught that Peace in Industry does not depend on rhetorical acquiescence by the national employers and trade unions in invertebrate resolutions, "necessarily general in their terms in order to avoid incongruity with the special circumstances of particular industries." "It depends primarily on the employers and trade unions in each particular industry sitting down together and trying to agree on their own terms of peace and co-operation."

Wages in the Engineering Industry.

THE negotiations which have been in progress for a very long time between employers and employed in the engineering industry have now reached an unquestionably critical stage. Nothing need be said which belittles either the difficulty of engineering concerns in securing business in sufficient volume and at profitable prices under the prevailing conditions, or that of skilled workers who receive remuneration which everybody admits is low in com-

parison with that paid by sheltered occupations. We believe that both parties are to be sympathised with in the difficult situation in which they are found. Again and again the two sides have faced each other discussing their difficulties together and trying to find some form of compromise. Companies are unable to earn a return on their capital, and while this is so the very existence of the undertaking which provides employment is imperilled; indeed, some works have already been closed down. Added to existing difficulties there returns the menace of German competition. Mr. Brownlie attended meetings of German workmen some weeks ago and placed before them the effect of their working for longer hours and at low pay upon the conditions of workers in the same classes in this country. On the last occasion when the employers and employed met here it was understood that the men's representatives intended to lay the situation before the different localities. Last week, however, the pressing nature of the problem as it affects the employers led to definite action being taken by the Engineering Employers' Federation. This occurred at a further meeting of representatives of the Federation, and of the trade unions concerned in the recent application for an increase of £1 per week in the wages of men engaged in the engineering industry, which was held on April 23rd.

The employers' representatives presented their counter-proposals, which were as follows:—Instead of the present 47-hour week with a payment of 1s. per hour and a bonus of 10s. per week, they put forward a 50-hour week with the same hourly rate and a bonus of 12s. For night shifts they proposed a 52½-hour week instead of the existing 47-hour week, with a payment, where overtime and night-shift agreement applies, of time-and-a-quarter rates instead of time-and-a-third. With regard to the bonus, it was proposed that it should not apply to Belfast, where an extra bonus is already paid, and it should be altered *pro rata* for a lengthened or shortened week, but should not be subject to overtime, night-shift, or payment-by-result percentages. It is suggested that half of the increase in the bonus should be paid upon the adoption of the proposals, and the full increase at the end of six months from that date. The overtime rates put forward are:—On day-shift, time-and-a-quarter for the first two hours, and time-and-a-half thereafter in any one day; on night-shift, time-and-a-half. These rates compare with time-and-a-half for day-shift overtime up to midnight and double-time thereafter, and time-and-two-thirds for night-shift.

In a covering letter the employers explained the reasons for their refusal of the men's claim and the presentation of the counter-proposals. This refers to foreign competition and low output. It suggests that the Government should be approached jointly by the two parties with a view to its taking steps to secure that foreign workmen should not work longer hours than British employés. If this could be done the arrangements proposed could be reviewed. Trade union restrictions are also mentioned.

The trade union representatives expressed their surprise at the nature of the proposals, but they promised to submit these and the covering letter to a meeting of the union executives on May 20th.

It is to be hoped that sober judgment will prevail on this occasion, and that even if the proposals put forward by the employers are not accepted they will be considered in a practical fashion and reasonable amendments suggested.

Reports from the Manchester district state that there is little likelihood of the employers' proposals for a longer week being accepted in that area, and express the view that the industry will pick up again if left to itself, as unemployment in engineering labour there is gradually lessening. Twelve unions in the Derby district are also determined to resist the employers' proposals.

Standardising Frequency.

LAST week a conference was held in Birmingham, of representatives of leading electrical undertakings whose frequency of supply differs from the frequency of 50 cycles per second, which it is proposed to make the standard for the whole country. Our Glasgow correspondent informs us that the electrical engineer and manager of that city submitted a report to the Corporation Electricity Committee with regard to the effect of the proposed change, and its advantages, expressing the view that if the Government would bear the expense entailed the change-over ought to be gradually carried out. In Glasgow the change would be from 25 to 50 cycles.

In Birmingham a similar change would be necessary, and it is well known that the city electrical engineer, Mr. R. A. Chattock, is strongly opposed to the proposal, holding that the money could be better spent in other ways, and that the installation of stand-by plant is cheaper and better than the erection of long interconnecting mains. A great deal depends upon the local conditions so far as interlinking is concerned; short links, such as those between London stations, between Manchester and Salford, Sheffield and Rotherham, may be expected to prove economical from all points of view, but when the distances are greater there will be found a stage beyond which the reverse is the case.

With regard to standardising frequency, however, there are weighty arguments quite independent of the question of interconnection. There is no doubt that if all a.c. motors were built for one standard frequency, they could be materially cheapened, to the advantage of manufacturer, user, and supply undertaker; and the owner of portable a.c. apparatus would be relieved of one of his worries. Again, where the supply to domestic users is given at a frequency of 25 cycles, the question of flicker arises; it may not be noticeable with large lamps, but is perceptible in the case of high-voltage low-wattage metal-filament lamps, and may be not only irritating but actually injurious to eyesight. We hope, therefore, that the time may come when 50 cycles is the standard frequency throughout the country.

Artificial Lighting and the Architects.

THERE is an impression, not entirely unjustified, that architects attach more importance to the natural lighting of buildings of distinction than the provision of artificial illumination. Natural lighting is admittedly a question of great importance. The paper read before the R.I.B.A. on April 20th by Mr. P. J. Waldram, reviewing methods of determining access of natural light into buildings, was a useful contribution to this field of knowledge, of which he has made a special study. We cannot help thinking, however, that the author would have done better to confine himself to this aspect, instead of including artificial lighting as a species of appendix, which was added to a paper already long and must have created an impression that artificial lighting is a matter of secondary importance. The way in which the matter was presented rather accentuated this impression.

It is when dealing with the lighting of an exceptional interior, when such matters as transmission of light through translucent glass panels, or reflection from extensive surfaces, or the effects of shadows have to be considered, that the joint efforts of the lighting expert and the architect become necessary. Flood-lighting alone (a subject dismissed by the author in a few lines) involves many considerations on which the views of architects should be heard. We wish that the Illuminating Engineering Society, which specialises in this form of co-operation, could arrange for a suitable paper dealing with selected aspects of artificial lighting from a broad and not too strictly "engineering" aspect, to be read before the architects. An address on the lines we have in mind would involve a wide outlook on illuminating engineering; but in view of the large amount of information collected in past discussions it should be possible to find someone who could deal with it efficiently.

E

The Power Required for Pulverising Coal.

By R. H. PARSONS.

Among the drawbacks with which pulverised coal firing has to contend are the high initial cost of the plant and expenditure on power and maintenance involved in the operation of the system. The capital expenditure will no doubt approximate more and more to that of stoker plant as time goes on, for competition will bring the price down and stoker-plant will tend to become dearer as larger combustion chambers, water-cooled side-walls, preheated air and other modern improvements are adopted. Furthermore, if the unit system of powdered coal firing is developed, with the consequent abolition of coal driers, cyclone separators, storage-bins, and all the other costly and cumbersome apparatus required for the central system, the advantage in first cost may well be on the side of pulverised fuel. The cost of power for pulverising will nevertheless remain, whichever of the systems is adopted, and as the efficiency of stoker-fired boilers creeps up with improved furnace design, there is less and less margin of saving to offset the cost of pulverising power.

If we assume under present conditions that the change to pulverised coal firing would raise the efficiency of a 50,000-lb. boiler from 80 to 84 per cent., this would reduce the fuel consumption from, say, 6,250 to 5,950 lb. per hour at full load. We should thus effect a saving of 300 lb. of coal per hour, which in a modern station with a thermal efficiency of 18 per cent. would be equivalent to about 200 kilowatt-hours per boiler. Out of this saving we have to meet any extra capital and labour charges, and to find the power necessary to pulverise the coal, and operate the dryer, separating fans, and all other apparatus incidental to the plant. This work is frequently stated to absorb about 20 kWh per ton of fuel pulverised, and on this assumption it would require about 53 kWh in the case we have considered. The net saving would therefore be 147 kWh, which might be regarded as sufficient to warrant the change, if the total expenditure on capital and labour accounts were not too great a set-off. It must be remembered, however, that this saving is calculated upon full load conditions with good coal, and quite different figures might be obtained in other circumstances. The pulveriser has to pulverise everything which is fed into it, and with a poor grade of coal, the power used in pulverising the large ash content is entirely wasted. It is reasonable to suppose that the silicious material in coal requires more power to pulverise it than the carbonaceous material, so that with poor coal, not only has more power per ton to be expended, but more tons have to be powdered to do the same work in the boiler. Hence the cost of pulverising per ton of steam raised may amount to a very considerable item if the conditions are adverse to the pulveriser.

Very little information as to the performance of pulverising machines has yet been published, so that all the more interest attaches to some tests recorded by Mr. Henry Kreisinger in a paper read recently before the American Society of Mechanical Engineers. Mr. Kreisinger is one of the engineers of the Combustion Engineering Corporation of New York, and the tests referred to were carried out on pulverisers of the Raymond type as usually employed in connection with powdered fuel installations on the Lopulco system. The Raymond pulveriser operates by the action of small rollers suspended on pendulum arms, which are rotated so that the centrifugal force of the revolving arms presses the rollers against the interior of a fixed ring and so causes the coal to be crushed against the ring. Three series of tests are recorded, each series made with a different quality of coal and at a different plant, the machine in every case being similar and of the six-roll type.

From the data given in Mr. Kreisinger's paper the diagram reproduced in fig. 1 has been prepared to show graphically the performance of the machines. The horizontal scale gives the kilowatts taken to drive the pulveriser, while the vertical scale shows the quantity of coal dealt with per hour. Each series of test results has been enclosed by joining the extreme points by straight lines, thus keeping the three series separate and indicating roughly the extent of the variations of power and output in each case. The group of eight tests marked A shows the results obtained with Illinois coal. The power taken by the machine was, as will be seen, almost constant, varying only between 77.2 kW and 79.3 kW for a variation in output from practically 3½ to 6 tons per hour. This is a very striking result, and it cannot be dismissed lightly, as the individual tests varied in length from 13.99 to 58.86 hours, so that starting or stopping errors would be of negligible effect. The only conclusion which seems possible is that the power taken to drive the machine itself was so high that the additional work required to crush the coal was almost negligible by comparison. If a line through the plotted points is continued downwards, it would indicate that more than 70 kilowatts would be absorbed in driving the machine light, which seems incredible, especially as so gross an inefficiency is not indicated by the tests of the other machines. The average moisture content of the coal in this series, before pulverising, was 3.2 per

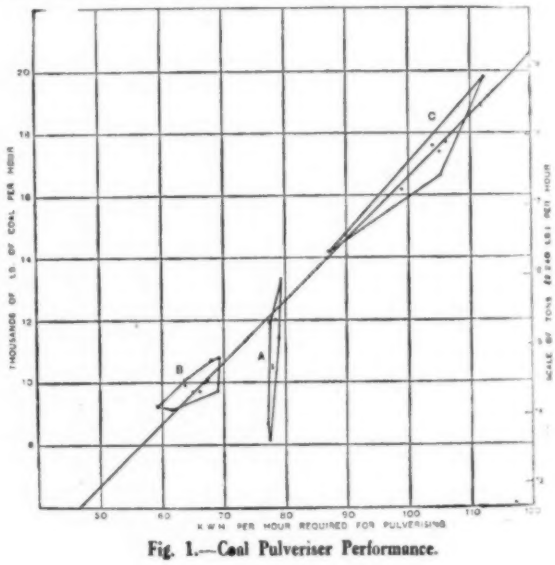


Fig. 1.—Coal Pulveriser Performance.

cent. In two of the eight tests the coal was undried. These two tests are represented by the two lowermost points of the group, which are distinguished by circles round the dots. The moisture content of the coal in the tests in question was 6.1 and 6.2 per cent. respectively; that in the other six dried coal tests ranged from 3.7 per cent. to 6.0 per cent. The power consumption per ton at the highest output was 13.2 kWh, and at the lowest was 21.3 kWh. In all cases the average fineness of the pulverised coal was such that 95 per cent. would pass through 100 mesh and 76 per cent. through 200 mesh.

The next group of tests, marked B in fig. 1, comprised eleven runs with undried Pennsylvania coal, with a moisture content varying from 1.6 to 2.4 per cent. The fineness of the finished product was the same as in the tests just discussed. The Pennsylvania coal is hard, and the maximum output of the mill never reached five long tons per hour. At its greatest duty, namely, 4.82 tons per hour, the power required was 14.3 kWh per ton, while at the minimum output tested, namely, 4.07 tons, the power consumption was 15.1 kWh per ton. The tests in this group varied from 6.35 to 14.26 hours

each in duration. The group of tests marked C was made with undried New River coal, which is softer than either of the other kinds. This characteristic is reflected in the greater output obtained from the machine, one test being made at the rate of nearly nine tons per hour, with a power consumption of about 12.6 kWh per ton. In these tests the moisture varied from 2.0 to 3.1 per cent., and the coal was pulverised to a fineness which allowed 98.5 per cent. to pass through a 100 mesh, and 81.5 through a 200 mesh.

A straight line has been drawn on the diagram which represents fairly well the average of the C group of tests. The continuation of this line passes through the B tests in the manner shown, and although the two sets of tests were made with different coals, it appears not unreasonable to suppose that the line represents a rough correlation between the output of a pulveriser and the power consumed. Even the A group tests are about as consistent with the line as they are with each other, especially if the two which were made with undried coal are neglected. The line drawn is represented by the equation—

$$K = 16.125 + 11.34\ T,$$

in which K represents the number of kilowatts required to pulverise coal at the rate of T tons (of 2,240 lb.) per hour. This agrees with the average of the results obtained, but it is to be seen from the diagram that an extra 5 kW at all outputs would have to be added to include the whole of the tests in groups B and C, and even then the worst of the A tests would not be covered. Hence the equation would become in round figures

$$K = 21.2 + 11.5\ T$$

to be at all safe to estimate from. The magnitude of the constant loss of 21.2 kilowatts indicates the desirability of always operating a pulveriser as near to its full capacity as possible if power is to be economised. This is an argument for the central system over the unit system, for in the latter the pulveriser must of necessity run at the load corresponding to the output required of the boiler at any time, unless more than one pulveriser is installed per boiler.

From the second of the equations given, the following table may be formed to serve as a guide to the power required for pulverising:—

Tons of coal pulverised per hour.	Kilowatts absorbed by pulveriser.	Kilowatt-hours per ton pulverised.
1	32.7	32.7
2	44.2	22.1
3	55.7	18.6
4	67.2	16.8
5	78.7	15.7
6	90.2	15.0
7	101.7	14.5
8	113.2	14.1
9	124.7	13.8

Two facts must, however, be borne in mind when using the table. In the first place, the figures are deduced from the performances of one particular type of machine operating on coals containing little moisture, and it is possible that different results would be obtained from machines of other types working on other coals. Secondly, it seems likely from the tests which have been considered that the higher outputs quoted could only be obtained from the machine in question when soft coal was operated on. Hence it is not safe to assume that a machine which will pulverise a given quantity of one kind of coal per hour will deal with an equal quantity of a harder coal in the same time, however much power is available. It would be of great interest to power station engineers in this country if reliable figures could be published as to the performances of roller-grinding, ball-grinding, and impact machines when working on various classes of British coals.

Electrical Enterprise in France.

The Notable Progress in Railway and Rural Electrification Schemes of 1924 likely to be exceeded this Year.

(From our Special Correspondent in France.)

At no period in the economic history of France has so much attention been devoted to the production and distribution of electrical energy, mainly for industrial purposes. The principal hydraulic resources of France represent a total horse-power normally available of 775,210 h.p. in service, 339,600 h.p. under construction, and 4,003,150 h.p. projected. Important and widespread as were the State-aided and private undertakings of 1923, and notable as was the extent of construction accomplished in 1924, the current year seems destined to witness an even greater amount of progress in this field of industry. The entire length of railway electrification determined upon is 5,600 miles, belonging to the Southern, the P.L.M., and the Paris-Orléans companies.

Following upon the practical completion of the installations at 150,000 volts of the railroads of the Midi, the progress made upon the construction of the great feeder at 150,000 volts of the Orléans railway, the enlargements of the generating stations serving the most populous region of Paris, and the putting into service of the State system at 45,000 volts in the north of France; to make only bare mention of the completion of new sections of the Paris underground lines at 60,000 volts, or of the progress made upon several additional lines at 120,000 volts (such, for instance, as those that will transmit to Lyons the energy produced by the Vidaire plant situated in the Alps), it has been decided to proceed more expeditiously with the electrification of the Paris-Orléans railway, which is to be finished, according to programme, during the current year.

Of this highly-important undertaking, the first section will take in the track between Paris and Brive, forming part of the line between Paris and Toulouse and the two junction lines, one from Saint Sulpice to Gannat, and the other from Brive to Clermont. The power for these services will be taken from plant established at Coindres, on the Chavenen, and at Celette, on the Rhue. The Coindres plant, which has also made considerable progress towards completion, will, it is believed, be opened for operation by the end of 1926. Between Eguzon and Les Aubrais there will be two high-pressure lines, one of 150,000 volts, and the other, between Chevilly and Les Aubrais, of 90,000 volts. The work upon these lines has already been completed; in fact, the last-named has recently been put into public service.

There will be two transformer stations, one located at Chaingy, near Orléans, and the other at Chevilly, to connect the systems of 150,000 volts and 90,000 volts. The Chevilly station has now been placed in operation, while, within a few weeks, that at Chaingy will be in use. Between the capital (Paris) and Vierzon there will be in all 11 sub-stations. Of these the first two (Paris-Ivry and Ablon) will be supplied by a line at 15,500 volts. Three sub-stations—St. Michel, Etrechy, and Saint-Cheron—with lines at 90,000 volts, have likewise been opened, while the other six sub-stations—Monnerville, Château Gaillard, Les Aubrais, La

Ferte-Saint-Aubain, Nouan, and Theillay—are still under construction, and will probably not be completed before September or October next.

With regard to the provision of electric rolling stock, orders have been placed for thirty large locomotives of the gearless type, with a rated capacity of 2,300 h.p.) to be built in the United States. The question has not unnaturally been raised why these locomotives should not have been built in French shops. It would appear, however, that the widespread demand for electricity throughout the industrial districts of France has so completely monopolised the output capacity of existing manufacturing establishments that it has been absolutely impossible to cope with the extra work entailed by the construction of a number of electric locomotives.

One of the engines received from America has already been delivered and, upon a trial run, a speed was attained of 110 km. (68 miles) per hour. This test took place on several selected stretches of track between Paris and Vierzon. When the trial run took place in the United States, the locomotive developed a speed of 170 km. (105½ miles) per hour. The difference in speed is accounted for by the poor condition of the road-beds in France. Before the new locomotives can be put to their full test, it will be necessary to considerably improve the tracks, and to complete the electrification plant. The utmost speed that need be attained is 120 km. per hour, for this represents the maximum rate of running authorised upon French railways.

But the electrical development of the railways forms merely a portion of the electrification activity now manifest in France. Substantial support has been given by the central and southern districts of the State to electrical farming operations. A number of projects have been formed; the irrigation of 500 acres, situated upon that section of the electrified area now in the hands of the Compagnie du Rhône, is about to be inaugurated as a beginning. The aggregate power obtainable in this one section of the country is estimated to be equal to that derivable from all other sections located above the city of Lyons. Marseilles will take the greater part of the Rhône water available, while any surplus not required for Marseilles and the riparian towns will be distributed to irrigated farms, such as those in the districts of Avignon and Valence. This scheme, when carried out, will provide means for bringing land, at present entirely barren and commercially useless, into fruitful cultivation, but it will not be ready for operation until 1927. The experience recorded in that part of French territory which has already been put under cultivation by means of electrical irrigation, affords every indication of this further project proving a financial success.

La Meridionale, of Carcassone, some time ago electrified a large portion of the farming region located in the Aude. The installation called for an outlay of 1,000 francs for each isolated farm, and 250 francs for each inhabitant of a hamlet. It is now estimated that to erect a central plant capable of producing 10,000 kW, the sum of 25,000,000 francs must be expended. For the construction of the distributing system a further 50,000,000 francs will be needed, so that in order to provide and utilise 10,000 kW of electricity under normal rural conditions a capital of at least 80,000,000 francs must be found. While this ambitious enterprise has not yet been realised, in view of the strong support forthcoming from manufacturers, farmers, and others who have become interested, there is reason to believe that the necessary money will be contributed. Indeed, there is every inducement to encourage the new method of farming. Not only will the introduction of electricity serve to improve the economic conditions of country life generally, but it will lower the present high cost of labour, increase the number of small factories, diminish, by several points, the swollen rentals of houses by dispersing the population over a wider area, and put an end to the serious emigration of able-bodied men and the crowding of others into cities—all evils from which France is now suffering acutely.

National Electric Power.—II.*

By R. C. ANDERSEN.

Before any proposals for the readjustment of British electricity supply can be logically criticised it is necessary to grasp:

A. The exact significance of the industry as such.

B. The influences that have operated to make the electricity business what it is in Britain.

Definition of the industry will demonstrate what a unique communal asset it is, and therefore the importance of developing it on sound lines. A study of the influences that have been and are at work will indicate the weaknesses calling for elimination. With the findings of this dual investigation as a background, it is hoped that the constructive programme put forward will be clear.

The Electricity Supply Industry.

The pace of modern civilisation is increasingly rapid; consequently all things leading to economy of effort have assumed fundamental importance. Electricity is the swiftest and easiest medium at man's disposal for the conservation of human energy, and therefore it may be classed as perhaps the paramount factor of human progress looked at from a materialistic angle.

To-day electricity has developed into such a necessity for the urban dweller that he cannot conceive a non-electric city. But this is not all. The power behind the switch has revolutionised industry. So profound indeed has been the change that production as we know it would be very seriously crippled were electricity suddenly to be eliminated. At home, in the office, and in the workshop alike it has become a vital product.

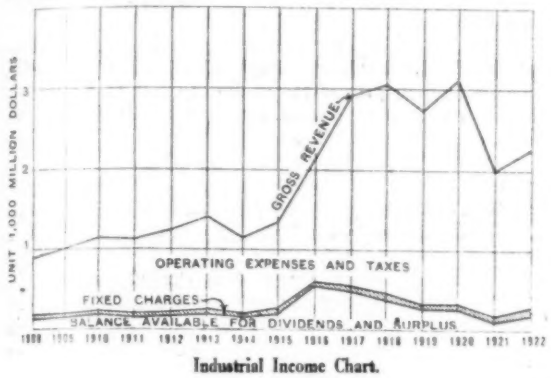
When one grasps the true significance of electricity supply in its relation both to the average individual's existence and to the wealth-producing capacity of a nation, it does not come as a surprise to learn that the industry's earnings are singularly stable. This stability is one of its unique characteristics. Nor is it difficult to advance reasons why it is not subject to the fluctuations—sometimes violent—that affect practically all other enterprises. In the first place, however bad a trade depression, its effect on the demand for electricity is slight. People must have light and heat, and houses must increase in number. Thus, though power supplied to workshops may dwindle because of bad times, the lighting and heating load is ever on the upward grade. Then labour, comparatively speaking, is a negligible factor. A power business has a smaller labour content than any other of similar status, so that wages figure relatively little in the cost sheet. Again, the business is transacted on a cash basis. Outstanding bills result in discontinued service, and thus bad debts are few and their value is reduced to a minimum.

The following representative curves†, based on actual data, are submitted to show the stability of electric power companies' earnings when compared with those of railways and various industrials taken in the aggregate. The industrials, amongst others, comprise those relating to copper, beet sugar, alcohol, iron and steel.

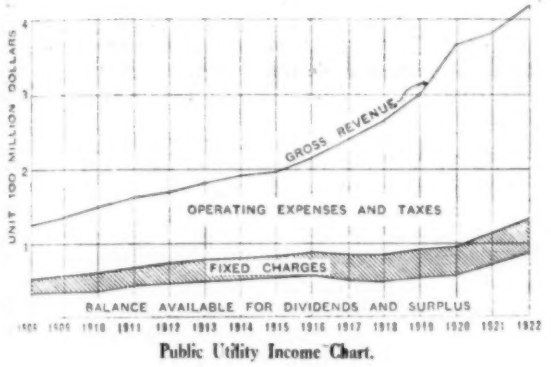
* The first article appeared in the issue of April 24th.

† Reproduced by courtesy of Messrs. West & Co., Philadelphia.

leather, and electrical manufactures. The period covered extends from 1908 to 1922. The comparative effect of the trade depression in 1921 will be noticed:—



Industrial Income Chart.



Public Utility Income Chart.

Another interesting characteristic of the light and power industry is the unusually important part finance plays in its undertaking. It has been computed that it requires 4.5 units of capital to produce one unit of output, whereas to cite an instance for the purpose of comparison, in the iron and steel trade the ratio of capital to unit output is as 0.9 to 1.

The capital first indicated is sunk in large head works, powerful hydro-electric and steam stations, and high- and medium-pressure transmission and distribution systems. Inasmuch as rapid expansion is still normal to the indutry, the latter's demands on the money market continue to be both regular and heavy. A day will come when, with supply catching up demand, the capital-output ratio of 4.5 to 1 will decrease sensibly, but that day is still a very long way off. Meanwhile the great thing to realise is that it is only because of the proven stability and permanence of electrical undertaking that the huge sums necessary for their development have been so consistently and easily forthcoming from the investing public.

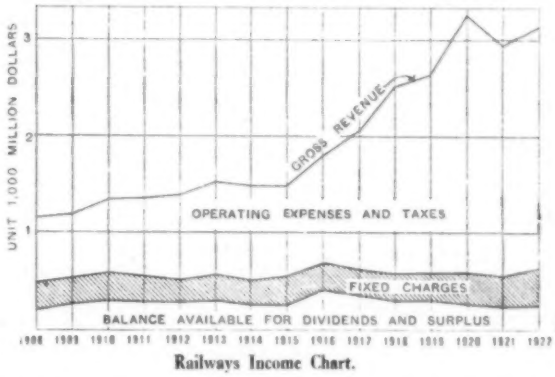
The definition I set out to attain can now be recorded.

The electricity supply industry is a vital communal service which, analysed as a busines, requires an unusually heavy capital outlay per unit output. Despite this deterrent, its earnings are extraordinarily stable because of:—

(*a*) Its assured market, regardless of trade depression.
(*b*) Its small labour content.
(*c*) The cash basis on which it conducts its transactions.

From this definition it will be seen that far from there being any obstacle of note inherent in the industry which might militate against a rapid and prosperous growth, it possesses to an unusual degree all the ingredients that make for a phenomenal success. Properly regulated, it is bound to flourish, so that failure to develop can only result from outside causes, principal among which I class obstructive legislation. British electricity supply has been stigmatised as backward, and according to the preceding statement this must be due to the legal aspect of the industry in Great Britain. Such indeed is my contention, and I therefore now propose briefly to survey the Parliamentary influences that have throttled electrical expansion in this country.

The laws governing British electricity supply contem-



Railways Income Chart.

Detrimental Influences Operating on British Electricity Supply.

plate three types of undertakers, *viz.*: Authorised distributors, power companies, joint electricity authorities.

The powers given to these undertakers are interesting in that they represent three definite stages in the development of the use of electricity.

Authorised distributors date back to the 'eighties when electricity was looked upon solely as a means of lighting. Power companies following on a few years later brought home to the public the fact that there were other and equally important uses to which electricity could be applied, principally in the industrial sphere. The Joint Electricity Authority is a post-war product, and the powers bestowed upon it reflect the very latest economic views on the generation, transmission, and distribution of electricity. As the great majority of authorised undertakers and all the power companies received their orders prior to 1919, and as no legislation has since been passed affecting the intrinsic operation of these, Britain judged as an electric domain is in a curiously helpless position. We see a country endeavouring to progress within the stipulations of three sets of rules, each set created to meet specific economic circumstances which are not at all in harmony one with the other.

The authorised distributor functions in a very restricted area, and if it so happens that the distributor is a private company, the latter's concession by its terms is liable to be purchased by the local authority of that area at the end of a specific period, generally forty-two years. In this connection it is interesting to note that the purchase price in practically all cases is the fair market value of all lands, buildings, works, materials and plant of the company. No consideration is given for goodwill, &c. This fact alone precludes proper and economic development in the shape of the installation of really up-to-date plant and the erection of suitable networks for expansion.

If the authorised undertaker be the local authority, the position is but very little better. Admittedly there is nothing now to prevent the laying down of proper plant and networks, but the area is, relatively speaking, so microscopic that, judged by modern economic standards, the usual cost per unit of electricity supplied is unduly high.

In these circumstances, if true economy is to be obtained, the absolute rights of the local authority in the matter of electricity supply ought to be either modified or superseded.

Power company legislation is much more enlightened as regards area of supply and the conferring of its privileges on the company in perpetuity. But an amazing distinction is drawn between the supply of light and power respectively. Such a company cannot supply energy for lighting purposes. Here is a circumstance—deriving its influence from a dead past—which still persists in an age where power and light are accepted generally as two fundamental aspects of a single business.

The result of this artificial cleavage is exactly what

one would expect. There are to-day many authorised distributors whose organisations are merely subsidiaries of power concerns. The two groups possess the same boards of directors, the same secretaries, &c., and this very duplication, quite apart from its manifest inefficiency, shows the need of giving to the parent companies the necessary authority to supply electricity for all purposes.

The Joint Electricity Authority, as has been stated, is a post-war development, and the legislation created to enable it to function efficiently is developed on broad and sound lines. Its powers of supply are ample in that it can deliver energy for any purpose to its customers. Its area of supply is adequate, and provision has been made not only for the purchase of existing undertakings by agreement, but also for taking over the purchase rights of local authorities in return for the proper representation of the latter in the Authority's sphere. It will be seen at a glance that these powers and provisions go to the roots of the trouble existing in Britain, and such being the case, the obvious question arises: Is not the Joint Electricity Authority the solution of Britain's electrical problem? To formulate an answer it is necessary to glance for a moment at another aspect of this type of undertaking.

There is a most unsatisfactory element in the constitution of a Joint Electricity Authority. Made up of representatives chosen from various interests in a district, such as municipalities, power companies, and industrial undertakings, the Authority immediately manifests itself to be a local committee. Now the most important attribute of a committee is complete detachment. A virtue in its proper sphere, this attribute becomes a grave disadvantage when it is a question of running a business, and the generation, transmission, and supply of electric power is not only an involved business, but, as has been shown, it is a vital one requiring broad vision and bold handling. Such creative work a committee cannot do, and in these circumstances it is my view that the Joint Electricity Authority does not constitute the solution to the British problem.

Another point: The Authority is invested with the powers of apportioning any deficit amongst various undertakers in proportion to the supplies the latter have purchased from the Authority. This, it will be admitted, is a circumstance which inevitably must penalise the more enterprising undertaker, and very materially tend to restrict expansion.

The influences, past and present, which have resulted in the inadequate expansion of electricity supply in Britain are thus seen to arise to a very great extent from the principles underlying the electrical legislation handed down to us from the nineteenth century. Actually they are due to force of circumstance, for ours is not only the oldest industrial country, but in proportion to its area it supports more industries than any other. The uneconomic condition noted has been heightened both by lack of elbow room and by the native conservatism of our people. Unlike other countries, fortunate from the electrical point of view in having space (literally speaking) whereon to develop up-to-date systems regardless of effete legislation, we have been unable to get away from our very natural mistakes. Authorised distributors firmly established in their financial rights continue to function uneconomically in microscopic areas. Power companies with areas relatively adequate and with rights held in perpetuity, lack any lighting powers, though the domestic load constitutes an essential section of their business. The Joint Electricity Authority is a bold conception, which in my view falls short of success because of its constitution and the extreme improbability of such a committee being able to direct and manage a business effectively. It also leads direct to socialisation. What then remains? I submit "private enterprise" as my answer.

The I.E.C. and International Standardisation.

The Basis of Fair Competition.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E. M.I.E.E., F.R.Ae.S.

(*Continued from page* 648.)

Cut, thrust and parry; foil and counterfoil; wit against wit. Such is the order of the work of the scientific League of Nations, yclept the International Electrotechnical Commission, whose annual conference has just concluded at The Hague. All matters are, of course, conducted with diplomacy, tact and courtesy in the extreme, but one can see behind all the arguments the vital requirements of each nation. This all the more emphasises the necessity for international agreement. As an example, it is impossible for one particular nation at present to supply transformers to a certain other nation (or *vice versa*, for it cuts both ways), for the simple reason that the standard specifications of each country vary too widely. Again, much business is gained by those firms in competing countries, which camouflage the technical details of the performance of their apparatus. This will be avoided and the customer protected when all equipment is purchased to international specification. In this way competition will be forced on to a fair basis, and yet at the same time the designer will have more than ample scope for his skill. When a standard low pressure of 220 volts is proposed, the altruistic motives of a nation, which supplies nearly ninety-five per cent. of its consumers at 110-120 volts, is doubted when it claims, as its reason for supporting a low voltage, that it is because its consumers have the advantage of 15 per cent. gain in lamp efficiency. Powerful arguments in favour of constructing turbine alternator rotors with high temperature test limits are somewhat discounted when it is discovered that the manufacturing firms of that country have not yet found out how to build satisfactorily for low temperatures.

Undoubtedly the fairest basis for the comparison of electrical machinery is that of temperature rise on test. Hence a considerable portion of the time of the conference was devoted to this matter, though many of the delegates seemed to miss the importance of this point and dragged in other details. The British representatives were very dogmatic, and took a good deal of refuge under their National Committee, indicating clearly that they were not free agents. Either the decisions of that committee were very sound, or the attitude was the best one to take, for they carried a greater percentage of points than any other nation. Of course, it must be borne in mind that every nation had had the views of every other party for consideration at various stages during the past year. A peculiar difficulty arose in that there is no French equivalent for the English word "rating."

Traction Motors.—The crux of this subject was that neither the one-hour rating nor the continuous rating, nor both of them together, represented in any way the real conditions under which the motor would have to work in service. The discussion upon expert papers presented by Messrs. N. W. Storer (U.S.A.), F. W.

Carter and E. O'Brien (Great Britain), and A. Huber-Ruf (Switzerland) elicited the practical impossibility of any tests that would reproduce working conditions, which included also weather circumstances. It was pointed out that the day of the totally enclosed motor had passed, for the modern traction motor is now always fan ventilated. While the more authoritative attitude was in favour of the continuous rating, it was decided to retain the one-hour rating also, at any rate for the time being. After considerable discussion, the following Centigrade temperatures were decided upon:—

Continuous Rating.	Armature and Field Windings.	Class A Material	Resistance	85
			Thermometer	55
		Class B Material	Resistance	105
			Thermometer	85
	Commutator and Collector.		Thermometer	85
One-Hour Rating.	Armature and Field Windings.	Class A Material	Resistance	90
			Thermometer	75
		Class B Material	Resistance	120
			Thermometer	90 or 95
	Commutator and Collector.		Thermometer	75

Class A materials are: Cotton, silk, paper, &c., when impregnated.

Class B materials are: Micanite, mica splittings with binding cement and asbestos, &c.

It was also decided that the overload test should be based upon the continuous rating, while the excess load should only be a mechanical and commutation test (*i.e.*, not a temperature test). Further, it was agreed to measure the output of all traction motors at the shaft (*i.e.*, to the exclusion of all gearing). All tests to be made as in service, *i.e.*, with all the covers, &c., fixed in position. The one-hour test was recommended for running at full voltage, with three-quarters of the voltage for the continuous test.

Rating of Electrical Machinery.—A very important piece of work was accomplished by the Advisory Committee dealing with this subject. This was in deciding upon the temperature rises for large machines. The following table is a summary of the recommendations:—

TEMPERATURE RISES FOR LARGE MACHINES.

	Rotor Temperature Rises measured by Resistance.	Stator Temperature Rises measured by E.T.D.	
Steam Driven Turbine Type Machines.	Class B. Insulation 90° C.	Two coil sides per slot.	One coil side per slot.
		Class B 80° C. Class A. 60° C.	Class B. *(see note below).
			Class A. 20° C. less than the value for Class B.
Salient Pole Machines.	Class B. Insulation 80° C.	Class B. 80° C. Class A. 60° C.	
	Class A. Insulation 60° C.		

* In the case of stators wound with one coil side per slot, the permissible temperature rise as measured by embedded temperature detectors with the detector placed inside the slot lining but outside the insulating tube between the coil side and either the wedge or the bottom of the slot inside the slot lining shall be 70 deg. C. for windings having a rated pressure of 7,000 volts less 1½ deg. C. for every 1,000 volts above 7,000. If desired by the manufacturer, the temperature may be measured inside the insulating tube, in which case the permissible temperature rise shall be 85 deg. C.

The decisions given in this table represent a compromise that is the outcome of a struggle which has existed for a number of years between advocates of high temperatures and sponsors of low temperatures. The user, of course, would always prefer the lower temperatures.

The use of embedded temperature detectors for large turbo-generators up to 5,000 kVA, or with a core length of one metre, was approved. Previously the limit was up to 750 kVA with a core length not exceeding 50 cm. In the case of transformers, however, it was decided not to recommend the embedded detector method. The discussion elicited the fact that it was costly to use, and further that there was a fear of the induced pressures being excessive.

As regards tolerances, it was appreciated that definite allowances should be made, but it was considered advisable for the various National Committees to prepare definite lists of recommendations for consideration at a further meeting.

(To be concluded.)

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Robinson" Mirror Bowl.

Some excellent effects were obtained at the Three Arts Ball and the Chelsea Arts Ball held during the past season by means of a special mirror bowl supplied by Mr. G. W. ROBINSON, 39, Great Windmill Street, W.1.

One of these bowls is illustrated in fig. 1; it consists of a fabric bowl on which are placed at suitable intervals a large number of small circular mirrors. The bowl is suspended and rotated through gearing by a small electric motor and at the same time spot lights are concentrated upon it. The effect of this is a good imitation of a snowstorm without any of its inconveniences. The bowl used at the two functions mentioned at the beginning of this note was 6 ft. in diameter; the standard diameter, however, is 2 ft. 6 in.

Fig. 1.—The "Robinson" Mirror Bowl.

Fig. 2.—The "Lisenin" Plug

The "Lisenin" Plug.

From the accompanying illustration, fig. 2, it will be realised that the LISENIN WIRELESS CO., Connaught House, 1a, Edgware Road, Marble Arch, London, has evolved a plug of distinctive design that eliminates the use of all small screws. The strands of wire are turned back over the cone section, which is inserted into the recess of the plug and clamped down by the insulated sleeve. This is a good feature as it provides a positive connection that is difficult to break. The plug will accommodate the smallest flexible cable up to 5 m/m., and single strand cable from 14 to 40 s.w.g., while the cone is recessed to allow the insulation to fit close up and obviate any play on the bared wire. The insulating sleeves are made in red and black and the sockets are made to fit standard valve legs so that they may be used as valve holders in order to preserve the uniform appearance of the panel. A point that needs attention, however, is the taper of the plug, as the fit appears to be capable of improvement.

The "Pinnacle" Switch-Fuse.

We have received a sample of this novel design of switch-fuse, which is being marketed by MESSRS. PINNACLE SWITCH-GEAR, LTD., Weybridge. As will be observed from the general view, fig. 3, it is somewhat similar in general build to that of the usual type of small switch-fuse used in connection with public lighting fittings. The terminal contacts are contained in a circular chamber surrounding an inner chamber the walls and base of both being made of "bakelite," which forms with the case in which it is carried, the base of the switch. The switch contacts and the fuse terminals are carried by the door on a "bakelite" carrier in such a way that when the door is closed the switch contacts are allowed to "make and break" by the twist movement of an external handle attached to the carrier, the fuses being isolated in the inner chamber, thereby preventing a flash across the terminals in the event of the fuse blowing. A fool-proof locking device is attached to the handle, and locks the door when the switch is "on." A spring controlling the movements of the contacts provides an excellent "make and break." The switch-fuse is made in sizes varying from 15 to 500 A. Fig. 4 shows an interior view of the device. The steel parts forming the door-locking device are heavily coppered to prevent rusting.

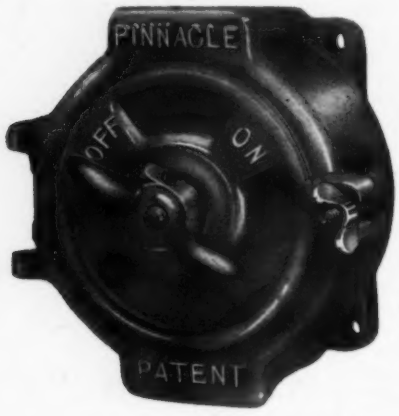


Fig. 3.—The "Pinnacle" Switch-Fuse.

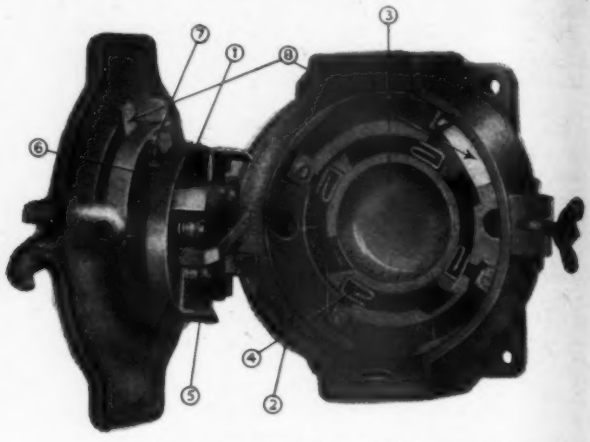


Fig. 4.—The "Pinnacle" Switch-Fuse—Interior.

Shop-window Reflector.

A new design of shop-window reflector is being put on the market by the SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 39, Upper Thames Street, E.C.4. These reflectors, which are made in two patterns, extensive and intensive, are lined with silvered mirror glass of the highest reflecting and diffusing efficiency, and are green enamelled outside. The extensive pattern is suitable for use in deep windows of moderate height, or where the height is equal to the depth. The intensive pattern is intended for use in the average shop window, the height of which exceeds the depth.

Fig. 5.—A New Shop-Window Reflector.

Both of these patterns are made in two sizes for use in conjunction with Siemens gasfilled lamps, the smaller for 60- and 75-W and the larger for 100- and 150-W lamps.

A standard neck measurement of 2¼ in. for all four reflectors permits the use of one size only of screwless gallery for any of the reflectors, thus eliminating all possibility of placing the lamp out of focus by using the wrong size gallery. For decorative purposes, glass colour screens are supplied in red, green, blue, and amber. These screens fit into a metal frame, over which the reflector is placed and held securely in position by two springs, the ends of which are slotted into the screwless gallery. The reflectors are mounted on batten holders or brackets fixed along the top edge of the window, the light being evenly directed over the goods displayed.

Fig. 5 illustrates the complete fitting with colour screen, with the extensive pattern reflector.

The British Electrical Development Association.

AT the recent annual meeting of this Association members were urged to increase their subscriptions. In view of this a special book is being produced for circulation among engineers and managers of electricity undertakings, as well as to members of the committees and boards controlling these undertakings. It is deemed desirable that engineers should defer action towards their committees until all the arguments contained in the book are available.

We have already reported the election of Sir George Sutton, Bart., as president of the Association for 1925-26. The following are vice-presidents:—Mr. A. F. Berry, Mr. R. P. Sloan, C.B.E., and Sir Philip Nash, K.C.M.G.; Mr. Sloan is also chairman for the year. The Council consists of 42 members, including the president. The following bodies are represented on the Council:—The Institution of Electrical Engineers (3 members); the British Electrical and Allied Manufacturers' Association (7); the Incorporated Municipal Electrical Association (7); the Conference of Chief Officials of London Electric Supply Companies (4); the Incorporated Association of Electric Power Companies (3); the Provincial Electric Supply Committee of the United Kingdom (3); the Cable Makers' Association (2); the Electric Lamp Manufacturers' Association (4); the Electrical Contractors' Association (3); the Electrical Wholesalers' Federation (2); Area Sub-Committees (2); and one co-opted member, Mr. E. T. Ruthven-Murray, M.I.E.E.

The Executive Committee is as follows:—Mr. R. P. Sloan, C.B.E. (chairman), Mr. S. T. Allen, Mr. Ll. B. Atkinson, Mr. A. G. Beaver, Mr. H. Bentham, Mr. A. F. Berry, Mr. W. F. Bishop, Mr. E. Boys, M.C., Mr. W. E. Bush, Mr. R. A. Chattock, Mr. A. C. Cramb, Mr. R. S. Downe, Mr. D. N. Dunlop, Mr. R. Hardie, Sir Benjamin Longbottom, Mr. H. Marryat, Mr. R. B. Mitchell, Major H. C. Palmer, Mr. W. F. T. Pinkney, Mr. L. L. Robinson, Mr. W. M. Rogerson, Mr. A. N. Rye, Mr. S. H. Stanley, Mr. C. W. Sully, Mr. W. C. P. Tapper, Mr. L. G. Tate, and Lt.-Col. W. A. Vignoles, D.S.O.

Incandescent Lamp Sales in the United States.—The sales of incandescent electric lamps, exclusive of miniature lamps, are estimated to have reached 278,000,000 in the United States during 1924. This represents an increase over 1923 of 33,000,000, or 12¼ per cent. The average price of standard lighting lamps is now one-third below their pre-war price. This reduction, which has been made despite the higher costs of both labour and materials, has been brought about by improvements in lamp-making machinery, which have doubled the output of lamps per operator and trebled the capacity of factory floor space. Miniature lamps also showed an increase in sales. An estimated total of 210,000,000 of these lamps was absorbed by the buying public, a gain of about 20 per cent. over 1923. The uses of these lamps were divided, approximately, between automobiles, pocket flashlamps and Christmas tree lights. Two-thirds of the entire number sold were for automobiles. The rest were about equally divided between the other two classes.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Handle of the Door.

Speaking from memory, it is many years since an eminent member of Messrs. C. A. Parsons, of Newcastle, published in the I.E.E. *Journal* a statement to the effect that "Man is inherently lazy." The late European eruption has undoubtedly done much to aggravate and amplify that trait, the result to-day being on the part of buying humanity a craving to obtain something for nothing or obtain it at a minimum expenditure of mental and physical energy, or, in other words, to save trouble.

Our retail electrical stores or shops frequently occupy excellent sites, and contain high-class stock and equipment, but to get to them and procure what we require we have to overcome our inherent laziness. Assuming that we have the cash and have decided to procure something electrical, what is our mental attitude? Our mind subconsciously runs through a list of probable means of obtaining the desired article at a minimum of trouble. We think perhaps of several firms; but dismiss most of them as "too much trouble."

Jones, because his stores is three streets away; Brown, because of his "take it or leave it" attitude and he has "Bolsh" assistants; Robinson, because we cannot get a 'bus to his door, and there is a communication trench to be negotiated before reaching his counter. The local supply authority's showroom, because of the "red tape" or because it is a corner shop and has two steps up, or because of difficulty in negotiating the outer door, the microscopic handle of which, should we venture inside, partially disrobes us on releasing it, when we find ourselves in a triangular chamber facing two half-swing doors each equipped with a 1½-in. handle, and if we survive after extricating ourselves from the openwork mesh of a metal doormat, we are told that the "gadget" we require is out of stock.

Show and sale rooms should invariably be on the ground floor, absolutely clear of obstructions, such as open-mesh doormats. Doors should open easily to gentle pressure, preferably more or less downwards, and if handle there must be, it should be of the single-lever variety with about 4 in. of grip surface. The ideal door is of the quadrant rotary type, as found at the entrance of good-class hotels and similar institutions, and entrances should be broad and free from turns. A great measure of success has been achieved by a firm of American origin, F. W. Woolworth, Ltd., in catering for our inherent laziness, which has equipped attractive premises entirely on the flat and with excellent means of ingress.

The principle is applicable to the electrical retailer, though the costliness thereof must, I admit, be restricted to his limited pocket; but the harvest to be reaped will reward appreciable outlay. Explore the shopping centres of the West End or Kensington, and you will find that the question of ingress has been carefully studied, but I do not suggest that the presence of an admiral in uniform is a necessary asset at the entrance of the electrical emporium.

The 1924 failure of Wembley may very largely be attributed, not to the individual's financial outlay, but to the expenditure of energy necessary to get there, and, above all, to the difficulty of getting in.

W. G. Rogers, A.M.I.E.E.

Re Napier-Kimber, Ltd.

Your issue of March 20th contained a report of the meeting of creditors of Napier-Kimber, Ltd., of which I was managing director for 12 years until October last year. This report is incomplete, inaccurate, and misleading in so far as several most important matters are concerned.

The report stated that a new banking account was opened when I left the company, and a creditor asked how it was that this account should have been allowed to operate to the benefit of the guarantor at the expense of the other creditors. At this point I got up and explained the matter at some length, but it is amazing to find that your report absolutely ignores this explanation. The fact is, of course, that the new banking accounts (there were two, not one as stated) did not in any way affect the liability of the guarantor, neither did they operate in any way against the creditors. There was and never has been any liability of the guarantor at the bank for the very simple and obvious reason that the assets of the company have always been sufficient to cover the debenture held by the bank several times over. It is true that I controlled the account into which all incoming moneys were paid, but I could only draw on this by transfer to either the trading account of the company or to the old account of the company. It is therefore entirely false to say that the liability of the guarantor has been affected in any way whatsoever by these accounts; they simply served the purpose for which they were intended, namely, to prevent any excessive or undue dissipation of the assets of the company by the directors, and so far as this object is concerned, the operations have undoubtedly had the effect of strengthening the position as regards creditors and protecting the assets of the company generally.

You also state in your report, relative to an agreement which I had with the company in regard to a liability for excess profits duty, "that matter might require some investigation." It is regrettable that your reporter did not mention that he had taken this phrase from the Receiver's report, neither did he state that he had omitted the context. What was intended by the Receiver to convey was that the claim for excess profits duty itself might have to be investigated. The origin and justification for my agreement with the company in this matter was quite simple. Some years ago I accepted a certain sum in settlement of commission due to me, and after payment of that amount considerable sums were still available for distribution among the shareholders. It was intended at the time that the payment of the sum in settlement of commission due to me should be independent of any claim for excess profits duty which might ultimately be made, and which could not at the time even be estimated. Such a claim was not finally made until the end of 1923. When I left the company my solicitors drew up an agreement covering my liability, as had been agreed 4½ years previously, and this is the agreement referred to. I may say that no E.P.D. has been paid, and this agreement has therefore not affected the position of the creditors by one halfpenny, yet one of the trade representatives, a Mr. Houston, was able to occupy the creditors' time for nearly three-quarters of an hour in discussing this entirely unimportant agreement.

Your report goes on to say that the same Mr. Houston remarked that it was a one-man company. I regret that your representative did not see fit to give the list of shareholders which was given to the meeting by Mr. Gillett; had he done so the absurdity of Mr. Houston's remark would have been obvious.

A. W. Kimber.

London, N.W. *April 16th*, 1925.

[It is of course impossible to give a *verbatim* report of such proceedings, and it is unusual to publish lists of shareholders. Our representative who attended the meeting is a man of wide experience, and he endeavoured to give a correct account of what transpired. He denies that the report is either inaccurate or misleading. In giving publicity to the above statement, we quote two paragraphs from the report of Messrs. Dixon, Wilson, Tubbs & Co., whose Mr. S. H. Gillett was appointed to act as receiver by the bank which held the debentures and as the liquidator in the voluntary liquidation. These bear upon the points controverted by our correspondent:—

Paragraph 13.—"On October 31st, 1924, after Mr. Kimber had resigned from the board, a new bank account was opened jointly in the names of Mr. A. W. Kimber and the company, all cheques to be signed by A. W. Kimber solely, the object being to attempt to decrease the overdraft by paying all receipts into this account in relief of the overdraft and of the liability of the guarantor."

Paragraph 17.—"By an agreement dated August 27th, 1924, the company gave to Mr. Kimber an indemnity against the excess profits duty amounting to £1,798 14s. 9d. This will require investigation."

Paragraph 17 is complete in itself; there is no other "context."—EDS. ELEC. REV.]

Lead-covered Wiring and Visible Bonding.

May I offer a word of advice on the above vexed subject?

Do as I did six years ago. Cut out lead-covered wiring, with all its troublesome and unsatisfactory bonding boxes—in other words, eliminate the necessity for bonding, by installing for all jobs a system without metal protection, namely, a tough-rubber-sheathed system.

Then don't worry—hundreds of jobs carried out thus have proved entirely satisfactory in all situations.

A.M.I.E.E.

April 20th, 1925.

Unlagged Steam Traps.

We have read with interest the letter of your correspondent, "W.E.P.," on the above subject, in your issue of March 27th.

The use of float traps and the practice of connecting them by long drain pipes to the points to be drained is, to say the least, far from economical. It must be remembered that every square foot of unlagged surface of either traps or inlet pipes in continual use may cause a loss of heat energy equivalent to about half a ton of coal per annum. An ordinary float trap may, therefore, waste several tons, quite apart from the connecting pipes. There are generally numbers of traps and many feet of pipes in question, so that the remark quoted by your correspondent, *viz.*: "What an awful waste of steam!" is certainly apt.

He proceeds to suggest that this may be ameliorated by lagging. This has already been attempted, but experience has proved that inasmuch as the traps require continual overhauling to keep the valves steam-tight the lagging is either obstructive or gets damaged. It is sufficient for the mechanics to have to break and re-make steam joints, without having to remove and renew lagging. It is true that some float traps are designed so that the valves can be got at and kept in order without this difficulty, but this is not the case with the great bulk of float traps.

It was these difficulties which faced our principal many years ago, when he, too, was "one of the contractors' young men" engaged in supervising the erection of power stations, and prompted him to invent a trap for the purpose of overcoming them. To effect this he adopted the expansion system, by which means he succeeded in reducing the radiating surface from several feet to so many inches, with a re-

duction in the loss of coal to one-twelfth. This trap is still largely used not only in power stations, but wherever steam is used on land or at sea, throughout the world.

Coming now to your correspondent's recommendation as to lagging the drain pipes, which, he states, are sometimes 40 or 50 feet in length, this, again, only partially cures the evil. Our advice to users is to eliminate long drain pipes by placing the traps near the source to be drained. While it involves the use of more traps of smaller size, it is in the end better than using a few large traps each draining from several sources with a network of long drain pipes all functioning, as your correspondent puts it, "as condensers."

London, *April 20th*, 1925.

Wm. Geipel & Co.

"Maxtorq" Motors.

Mr. Hoseason suggests that we have not been quite frank with him. If he had written us on his firm's paper, saying he would be much obliged if we would tell him exactly the results we obtain with our latest motors and let him have details of how we obtain them, he would not have been surprised if the answer from one competitive firm to another had shown a little—shall we say—vagueness, and the situation is not altered by the fact that he wrote to you instead of to us.

With reference to the squirrel-cage crane motor of 20 years ago, it wasn't a bad production for its time, but our recollection of it is that the crane started with a jerk, inching was too coarse for fine work, and the motor wouldn't stand up to being stalled (and continued inching practically amounts to this). At any rate, the motor wasn't good enough to come into common use.

The present Maxtorq crane motor can be inched to one-tenth of a revolution on the motor shaft, acceleration is smooth, and the motor can be stalled repeatedly for minutes at a time without damage.

Through his own disbelief in progress, Mr. Hoseason gets in a nasty blow at the whole electrical industry, for he suggests the motor cannot possibly have a better performance than one made 20 years ago. Think of it—all progress stopped 20 years ago and no hope of any in the future! What a cry for reviving British trade in the face of foreign competition:—

> "Buy our Twenty-year-old Pattern Motor. We have convinced ourselves there is no possibility of further improvement."

If Mr. Hoseason would give himself the trouble to cross Trafford Park, we think we could show him something that would at least modify his present very pessimistic attitude to modern squirrel-cage motors. Certainly anyone who honestly believes that squirrel-cage motors haven't improved during the last 20 years should stick to slip rings.

After all, isn't the world divided into two sets of people—those who do things and those who give most excellent reasons why they can't be done?

The Lancashire Dynamo & Motor Co., Ltd.
(A. P. WOOD, *Managing Director*.)

Manchester, *April 20th*, 1925.

Aeroplane Crashes and Ignition Circuits.

I have read the article on page 406 of the ELECTRICAL REVIEW for March 13th, 1925, entitled "Aeroplane Crashes and Ignition Circuits," by Mr. H. C. Booth.

Mr. Booth expressed surprise that "a well-known American firm has gone back to the original incorrect 1898 method." Permit me to express surprise that Mr. Booth has designated a method of connecting coils as incorrect without submitting test data to show that the voltages at the condenser obtained with one method of connection are actually greater than they are in the case of the method of connection which Mr. Booth believes to be correct.

In his analysis, Mr. Booth assumes that it is necessary when the secondary is connected to the end of the primary connected to the breaker mechanism for the high-pressure current to pass across the contact points to earth. Such is not the case. With the methods of connection shown in figs. 2 and 3, the primary and secondary windings together serve as an auto-transformer and the end of the primary connected to the battery is really one end of the secondary and is connected to earth through the battery in fig. 2, or connected directly to earth in fig. 3.

The effect of earthing the secondary as in fig. 2 of Mr. Booth's article is either to add or subtract from the total secondary turns the number of turns in the primary, say, from 1 to 2 per cent. of the total turns, and so far as careful tests are able to determine there is no other effect upon the voltage impressed upon the condenser. Measurements have been taken by a modification of the "crest voltmeter" and a vacuum tube valve for the circuits of fig. 1 and for the circuits of fig. 2 with the relative polarity of windings in the case of fig. 2 in both directions. Any appreciable difference could be determined and these results have been confirmed by very extensive endurance tests. The question of the various methods of earthing the secondary has been analysed and tested more than once by the firm responsible for the ignition of the Liberty engine. It is hardly conceivable that the circuits of fig. 2 would be used unless experience as well as theoretical analysis and laboratory tests had shown that the condenser performance was equally satisfactory when the secondary is earthed through the primary or when it is earthed directly.

It would be very unfortunate if Mr. Booth's article resulted in an unfounded lack of confidence in the ignition system on the part of the users of aircraft.

J. H. Hunt,
Head Electrical Division, General Motors Research Corporation.

Dayton, Ohio, *March 24th*, 1925.

Unbusinesslike Procedure.

Mr. R. C. Andersen, in his illuminating article in your issue of April 24th, says: "Here (Electricity Commissioners' annual report) was a clear statement that British electric power supply was not expanding on the . . . rational plane that it should do." This, to us, is not surprising. Civil Service red tape and lack of "business sense" apparently permeate the staffs and organisation of our supply authorities, even when these are privately owned, *vide* our present experience:—

Two weeks ago the former tenant vacated these premises. A gas fire and electric light, with meters to match, were installed and in daily use. The tenant informed the Gas Co. and the Electricity Supply Co. that he was vacating the premises, and that new tenants were to move in the next day, the installations being required by them also. The Gas Co. sent a representative before we arrived, who read the gas meter, and on the housekeeper's assurance that everything was in order and perfectly safe, he left the installation as it was. We have used it daily since, and have received very courteous service from the Gas Co.

The Electricity Supply Co. sent a man also just before we arrived, who received the same assurance from the housekeeper. He, however, took the meter away, and since then we have written, 'phoned ten times, had two visits from different members of the Supply Co.'s staff—and still use candles for lighting. Our letter (on moving in) was ignored because we had not enclosed a completed form. In our 'phone conversations each day with one or other of the Supply Co.'s staff we are promised the installation of a meter the next morning, the man to bring a form for completion with him. There is always a pained surprise that we do not stock the Supply Co.'s various forms, but no hint of giving real service or anxiety to obtain more custom.

What electricity supply needs more than anything (except, perhaps, standardisation) is "go-getting" business methods. If we were not dealers in electrical goods we should have been compelled to have gas lighting long ago, but a large display of electric lamps, &c., surrounding a gas mantle would be rather incongruous!

Belbin & Bowden, Ltd.,
H. BELBIN, *Director*.

London, *April 27th*, 1925.

Conditions in South America.

Regarding "Hispano's" recent letter, "U.S." has given most excellent advice in his answering letter, and "Hispano" should act on that advice, and not try his luck unless he has good financial reserves. As for sharks, they seem to exist in all countries. I feel certain that all English residents in Latin America, and most Latin Americans as well, would always do what they could to assist such as "Hispano." What little knowledge I have will be at "Hispano's" service if he cares to write me.

Nueva Granada.

April 25th, 1925.

Remote Control Relays.

With reference to the article on p. 647, in fig. 1 of the relay switch and also in the descriptive matter the mercury used seems to have rather unusual characteristics, as it conveniently piles up to receive the contact bar. This is probably an error in sketching; otherwise the idea of the author is quite good.

A. M. S.

April 25th, 1925.

Silver Jubilee of Marconi Marine Co.—On April 25th the Marconi International Marine Communication Co., Ltd., celebrates the 25th anniversary of its incorporation. The company was formed for developing wireless telegraphy for maritime purposes. Its influence has been world-wide and to-day there are few ships of importance that are not fitted with wireless apparatus, and one of the first contracts undertaken was for the British Admiralty for the installation of apparatus in 26 warships and at six Admiralty coast stations. The main part of the company's business, however, has been in connection with the Mercantile Marine. Several foreign vessels were equipped during 1900, and no fewer than 6,000 British merchant ships have been fitted with Marconi apparatus. Over 10,000 operators have passed through the company's hands during the last 25 years; the company provided a considerable number of expert telegraphists for special duty with various branches of His Majesty's Forces, and more than 6,000 Marconi operators saw war service. Approximately 5,000 men, varying in age from 18 to 25, have been trained free of charge by the company mostly between August, 1914, and November, 1920. Nearly 150 lifeboats have already been fitted with radio apparatus or are in hand, and over 200 British vessels are at present carrying direction finders.

Business Notes.

The "Budget."—Mr. Winston Churchill, the Chancellor of the Exchequer, introduced his "Budget" for the current financial year on April 28th. The proposals include a remission of 6d. from the standard rate of income tax and the increasing of the earned income allowance from one-tenth to one-sixth up to a maximum of £250; the maximum was previously £200. Death duties are raised, but the increase is balanced by a reduction in super-tax rates on incomes up to £15,000. It is proposed to re-impose the "McKenna duties" (on automobiles, clocks, musical instruments, &c.) upon July 1st, as well as other import duties. A larger scheme of State insurance (with improved old-age pension provision) is to become effective at the beginning of next year. The funds will be provided by contributions from employers and workpeople, the balance being found by the State. The rates are tentatively put at 4d. per man and 2d. per woman, to be contributed by both employer and employé. The scheme will be subsidised for a period of 80 years, when it will become self-supporting.

Mr. Churchill announced an immediate return to the gold standard, stating that the United States and Germany were already virtually in that position. He also stated that the estimates for the services would be subjected to careful scrutiny in an endeavour to obtain a progressive annual reduction of from five to ten millions.

Bankruptcy Proceedings.—J. F. GUEST, trading as L. D. and J. Guest, 97, Great Horton Road, Bradford, and as Guest and Robinson, Barkerend Road, Bradford, plumber, electrician and hardware dealer.—The application for discharge of this debtor was heard on April 22nd at the County Court, Bradford. It appeared that the receiving order was made on October 3rd last, and debtor had paid a first and final dividend of 6s. in the £ on liabilities of £437. The Official Receiver said that debtor apparently filed his petition owing to pressure by creditors, as he was not insolvent at the time. The discharge was granted subject to debtor's consenting to judgment for £1.

ARTHUR DONOGHUE, Rutland Avenue, Burnley, electrical fireman. The public examination of this debtor took place at the Burnley Bankruptcy Court on April 22nd. Debtor's liabilities were stated to be £237 and his deficiency £214; he attributed his failure to sickness and unemployment. The examination was adjourned.

J. H. PAINTER (Venables & Co.), electrician, 99, The Broadway, Cricklewood, N.W.—Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement E.C., appointed April 15th.

A. W. MATTHEWS AND F. G. MATTHEWS (Electrical, Gas and Engineering Co.), electrical, gas, and engineering contractors, 130, Main Street, Handsworth, Sheffield.—Last day for proofs for dividend, May 11th. Trustee, Mr. L. J. Clegg.

Company Liquidations.—WIRELESS EXPERTS, LTD., manufacturers of receiving sets, 312, Vauxhall Bridge Road, S.W.—A meeting of creditors was held on April 20th, when Mr. C. Latham, who represented the principal creditors, was elected to the chair. No statement of affairs was presented, but Mr. L. Craddock, the receiver for the debenture holders, and liquidator in the voluntary liquidation of the company, said that so far as he could ascertain the liabilities to the trade were £300, although that figure might be increased. There were also first mortgage debentures for £1,000, other debentures for £1,000, and deposits received from drivers of £175. The assets were estimated at £540, but there were preferential claims for £56, leaving net assets of £484. Mr. Craddock stated that there were practically no figures to go on, and he could only produce details of the approximate purchases, sales and expenses. People who proposed introducing capital were not satisfied, and required the books to be written up properly. Steps to write up the books properly had been taken, but the task had not yet been completed. He had advised a winding up. There had been difficulty in ascertaining who the creditors were, and it was only by hearing from creditors that he was able to ascertain many of the firms who were interested. He was of the opinion that the stock should be realised as soon as possible, although the present was not an opportune moment for the sale of such goods. Having regard to the expenses it was of no use thinking of continuing the business.

A creditor pointed out that the assets were insufficient to meet even the first debentures. There was nothing for the second debenture holders, and the creditors could not expect to receive anything.

Mr. Craddock said he was unable to state how the deficiency had arisen. His own view was that there had been bad buying, whilst possibly all the initial capital was eaten up by the wages and salaries paid in the first year. He understood that jobs were given to people who found capital, and presumably there was not sufficient work for them to do. The company was registered in May, 1923, with a capital of £1,500. Subsequently the capital was increased, and at the date of the liquidation the issued capital was £4,409. The first debentures were issued in December, 1923. One of the principal creditors said he understood that last September £1,000 of fresh capital was found for the company, and Mr. Craddock replied that he believed that that was correct. A further sum of £1,000 was also subscribed for shares in the company. According to the books no interest had ever been paid on the debentures. For a period of six months there were no entries in the cash book.

After some discussion it was stated that the debenture holders were willing to waive their security, and to rank for dividend with the unsecured creditors. It was decided to confirm the voluntary liquidation of the company with Mr. Craddock as liquidator.

J.W.B. ACCUMULATORS, LTD. (formerly J. W. Barnard and Haynes, Ltd.).—Particulars of claims by May 15th to the Liquidator, Mr. F. H. Conning, 4, Great Winchester Street, E.C.

GENERAL WIRELESS, LTD.—Winding up voluntarily. Liquidator, Mr. R. C. W. Clarke.

SINGAPORE ELECTRIC TRAMWAYS CO., LTD.—Winding up voluntarily for reconstruction purposes. Liquidator, Sir W. Plender, Bart., 5, London Wall Buildings, E.C.

WIRELESS EXPERTS, LTD.—Particulars of claims by May 22nd to the liquidator, Mr. D. V. L. Craddock, 2, Forbury, Reading.

Private Arrangements.—J. D. CAIG, A. CAIG, AND E. LAMEY, trading as Caig Bros. & Jones, 61, Renshaw Street, Liverpool, electrical engineers, &c.—A meeting of the principal creditors of the above was held recently, at the offices of Mr. P. S. Booth, accountant, Liverpool. The statement of affairs presented showed liabilities of £944, of which £863 was due to the trade, and £81 to the bank. The assets were expected to produce £545. After allowing £55 for preferential claims the net assets were £490, leaving a deficiency of £454. It was reported that the business was established in 1914. Mr. Lamey joined the firm two years ago, bringing in about £275. Mr. Archibald Caig left the business recently in order to reduce the expenses. Owing to pressing creditors a deed of assignment had been executed to Mr. Booth in order to protect the estate. A wireless section of the business was started a year or so ago, but it had not proved a success. Up to December, 1919, there was a loss on the trading of £209, and in the following year there was a loss of £150. During 1921 there was a profit of £82, and during the first two months of 1922 there was a further profit, but no figures had since been prepared. In the absence of any offer it was decided to confirm the deed already executed, while a committee was also appointed. It was stated that a general meeting of the creditors would be held. The principal creditors are:—

	£		£
Baxendale Bros.	214	Downes & Davies	69
Oldham & Sons	74	General Electric Co., Ltd. ...	165

S. THOMPSON, W. P. THOMPSON, and N. A. CLARK, trading as Thompson Bros. & Clark, and as the Empire Wholesale Co., Bristol, electrical engineers, &c.—The creditors were called together recently, when a statement of affairs was presented which showed liabilities of £1,019, of which £718 was due to the trade and £301 to cash creditors. The assets totalled £474, from which had to be deducted £38 for preferential claims, leaving net assets of £436, making the deficiency £583. It was stated that a deed of assignment was executed on April 14th. The cash creditors were relatives who were willing to withdraw their claims. A resolution was passed agreeing to accept a composition of 10s. in the £, payable on maturity of the deed, and secured. The principal creditors are:—

	£		£
Bristol Carbide Co., Ltd. ...	47	Siemens & English Electric Lamp	
Drake & Gorham Wholesale, Ltd.	35	Co., Ltd.	29
General Electric Co., Ltd. ...	43	Simpson, Baker & Co., Ltd. ...	152
Hall & Lane	37	Wholesale Fittings Co., Ltd. ...	116
Jenkins, Hill & Co., Ltd. ...	50		

T. H. JOYCE and L. A. SAWTELL, trading as the Contact Engineering Co., 219, Queen's Road, W., electrical and wireless factors.—The creditors interested herein were called together recently, when the chair was occupied by Mr. C. Arrigoni, of Messrs. C. A. Arrigoni, Ltd. A statement of affairs, prepared by Messrs. Corfield & Cripwell, was submitted, which disclosed liabilities of £1,104, all due to unsecured trade creditors. The total assets were £373. The debtors commenced business in March, 1924, introducing £50 capital each. It appeared that with certain lines they were fairly successful, but were unfortunately handicapped in other directions as regarded delivery of goods, and it was to that the debtors largely attributed their position. A net loss of about £150 was disclosed on the trading. The drawings of the partners had been as follows: T. Joyce, £89; and L. Sawtell, £226. It was decided to confirm the deed of assignment already executed to Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell. A committee of inspection was also appointed, consisting of the representatives of Messrs. Wendell Manufacturing Co., C. & A. Arrigoni, Ltd., and the Hampton Works Co. The resolution was subject to the claim of Mrs. T. H. Joyce for £260 being withdrawn.

G. BUSL (Wireless Warehouses, Ltd.), 37, Moreton Street, London, S.W.1, with branches at Liverpool, Leeds, Hull, Stoke-on-Trent, Hanley, &c.—A conference of creditors was held at the Institute of Chartered Accountants on April 23rd. Mr. S. Booth, of the Palatine Trade Protection Office, who presided, said that as regarded Wireless Warehouses, Ltd., the liabilities of this company to trade creditors amounted to £27,331. The assets amounted to £32,033, but from this had to be deducted a debenture for £3,000, which left net assets of £29,033. This total was subject to certain preferential claims, and there was a surplus of a little over £700.

With regard to the affairs of Mr. Busl, his estate was really a joint liability on bills for £20,000, and a liability in respect of bills with someone called Darag for £7,000, making a total of £27,000. His assets consisted of 4,999 £1 shares in Wireless Warehouses, Ltd. The business of the company was commenced in February, 1923, the trade done being purely a wireless trade; it was first started at Mr. Busl's private address at Sutherland Avenue. In July, 1923, premises were taken at Moreton Street, and Mr. Busl's capital at that time was between £200 and £300. He carried on business in his own name, and in April, 1924, started a branch in Liverpool. This was successful and subsequently further branches were opened in other towns. In December, 1924, the question arose of the desirability of forming a company, and a statement was prepared which purported to show that at the time there was a surplus of assets amounting to £8,701. The company was duly formed, and took over the whole of the liabilities and assets with the exception of the £7,000 of bills which he had previously referred to, and for which no consideration was given, or had since been received. The company was registered with a capital of £5,000, and £3,000 was advanced in cash to the company to meet certain current bills, and in respect of this £3,000 a debenture was created. Mr. Booth added that he had satisfied himself that this money was duly paid to the company and that it went into the bank account. The debenture holder was a Mr. Wyatt, and he was one of the directors of the company. With regard to the shares issued to Mr. Busl, no cash had been paid in respect of them. The company was registered on March 6th, 1925. The position undoubtedly was that creditors had a right to sue Mr. Busl, although there was a covenant whereby the company protected him; Mr. Busl had no estate except the shares in the company. Busl and Darag had had large transactions between them, and apparently Darag induced Mr. Busl and another to sign bills for a large amount and it was set out that they were not liable under the bills until the goods had been supplied, the idea being, apparently, that these facilities would enable Darag to purchase goods in Germany. Subsequently solicitors saw Darag and it was arranged that £3,600 should be paid to him in bills and he gave an undertaking to return all outstanding bills to Busl. The position, therefore, was that if Darag did not meet the bills Busl was liable, and also in some instances the other party he had referred to, although they had never received any consideration of any kind. Darag had negotiated some of the bills. Proceeding, Mr. Booth gave particulars of the turnover between February, 1923, and December of the same year, which showed that the business done was a very considerable one. His suggestion was that the company should be allowed to continue trading and if it was successful from September onwards, when the wireless season really started, then it was to be hoped that the company would be brought to a successful position.

Mr. HOUSTOUN said that in addition to the debenture for £3,000 issued to Mr. Wyatt, there was also registered a further debenture to Albert Lee & Co. (1923), Ltd., in respect of goods to be supplied. What was the position as regarded this second debenture? Had any goods passed under it, and were Albert Lee & Co. creditors or did they claim to have a preference? Mr. BOOTH said that this debenture was inoperative, and there was nothing owing under it.

Mr. LATHAM asked, in reference to the bills in connection with Darag, whether Darag was in a position to levy, but a reply was given in the negative. He asked further whether the £7,000 of bills was the amount remaining after the £3,600 of bills was met. A reply was given that £7,000 was still outstanding.

One creditor asked whether there was any connection between Albert Lee & Co. and the Wireless Warehouses, Ltd., and it was explained that Mr. Jos. Wyatt was a director of both concerns.

After some further discussion Mr. LATHAM said he would move a resolution for the appointment of a committee of five of the creditors to investigate (1) the formation of the company, (2) the issue of the debenture for £3,000, the consideration and the disposition of the consideration; (3) to negotiate with the present debenture holder as to whether he was prepared to relinquish his prior rights; (4) to investigate the issue of the second debenture, and (5) to report on the position and as to whether there was any reality on which a scheme of reconstruction could be founded. It was also suggested that the debenture holder should not appoint a receiver in the meantime. This resolution was carried, and a committee of five was subsequently appointed. Subsequently a creditor, who said he represented the Darag bills, addressed the meeting, pointing out that he represented holders for value, and the bills drawn by Darag and accepted by Busl. As far as he understood the position, the company had taken over all the liabilities of Mr. Busl but had refused to take over the liabilities represented by these bills. Under these circumstances and having regard to the way these bills to the extent of about £7,000 were issued, he was going to pursue his own remedies.

Dissolutions of Partnership.—A. J. KNIGHT & Co., electrical engineers, 18, Princess Street, Newcastle-on-Tyne.—Mr. A. J. Knight and Mr. M. Smith have dissolved partnership. Mr. Knight will attend to debts and continue the business.

T. HALL & Co., electrical engineers, 8, Lumley Road, Cheam.—Mr. H. H. Keast and Mr. T. J. Hall have dissolved partnership. Debts will be attended to by Mr. Hall.

YOUNG & LOWES, wireless and electrical engineers, 2, Victoria Chambers, Laura Street, Sunderland.—Mr. A. A. Young and Mr. R. E. Lowes have dissolved partnership. Mr. Lowes will attend to debts and continue the business in his own name.

Trade Announcements.—The YORK RADIO Co. have opened premises at 51, Coney Street, York.

The firm of BASTIAN & ALLEN is being amalgamated with the Bastian Meter Co.

MESSRS. LONG & CRAWFORD, LTD., have removed their London office to "Walter House," Bedford Street, Strand, W.C.2 (telephone number, Gerrard 2638), which will be in charge of Mr. E. G. Sheppard.

BELBIN & BOWDEN, LTD., have removed to more convenient premises at 3, Finsbury Square, E.C.2.

HEWITTIC ELECTRIC Co., LTD., have removed to Hersham, Walton-on-Thames, Surrey. Telephone Nos.: Esher 603, 604, and 605; Telegraphic address: Hewittic, Walton-on-Thames.

Catalogues and Lists.—SHEFFIELD STEEL PRODUCTS, LTD., Templeborough Works, Sheffield.—A price list of cast-steel files and rasps.

MESSRS. HUNTER & JACK, 38, Elliott Street, Cranstonhill, Glasgow.—An illustrated and priced pamphlet advertising "B.I." electric lamps.

MESSRS. MAY & PADMORE, LTD., Tyseley, Birmingham.—A sheet bearing illustrations of the company's exhibition stand fittings. Priced.

THE BRUSH ELECTRICAL ENGINEERING Co., LTD., Falcon Works, Loughborough.—Publication No. 0001, containing an illustrated description of the company's works and products. A section is devoted to records of performances of Brush-Ljungström plant.

MESSRS. S. SMITH & SONS (M.A.), LTD., Cricklewood Works, N.W.2.—An illustrated booklet dealing with the "Wootton" hand lantern and charging apparatus therefor.

THE GLOBE ENGINEERING Co., LTD., Brighouse, Yorks.—Price lists of small d.c. motors and battery-charging motor-generators and switchboards.

LONDON ELECTRIC STORES, LTD., Oxendon Street, Haymarket, S.W.1.—A comprehensive priced catalogue of electrical materials, accessories and appliances, including radio apparatus.

THE STONEBRIDGE ELECTRICAL Co., LTD., Victoria Road, North Acton, W.3.—Lists Nos. 61 and 62, dealing, respectively, with moving-iron and moving-coil instruments for switchboard mounting. Illustrated and priced.

ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10.—Leaflet L2, containing illustrated particulars of "Utility" current limiters and relays of various patterns and for a number of applications.

MESSRS. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, W.C.2.—A folder illustrating a number of patterns of "Universal" coffee percolators, as well as table stoves, irons, &c.

MESSRS. LESLIE DIXON & Co., 9, Colonial Avenue, Minories, E.1.—An illustrated catalogue and April price list of radio accessories of all kinds. Also leaflets dealing with amplifiers and valves.

SIEMENS & ENGLISH ELECTRIC LAMP Co., LTD., 38-39, Upper Thames Street, E.C.4.—Leaflet Z104, containing an illustrated description of "Zed" fuses, with characteristic curves of the performance of fuses of various ratings.

THE SUN ELECTRICAL Co., LTD., 118-120, Charing Cross Road, W.C.2.—An illustrated and priced catalogue of switch- and fuse-gear of all types; and a leaflet giving prices of the company's cables and flexibles.

MESSRS. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, W.4.—Pamphlet describing the recording "Dionic" water tester.

VACUUM OIL Co., LTD., Caxton House, Westminster, S.W.1.—A pamphlet stressing the value of lubricating oil specifications as an instrument of purchase. Details of physical and chemical tests are given.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A revised price list of conduits and fittings, and illustrated pamphlets dealing with "Simplex" universal circular connector boxes and fittings, interlocking switch-plugs and shallow multiple switch boxes, and conduit screwing tackle.

Industrial Property in the Irish Free State.—A Bill was introduced into the Dail Eireann on April 3rd making provision for the granting of patents for inventions, the registration of designs and trade marks, and the protection of authors' rights in the Irish Free State. The *Board of Trade Journal* states that under this Bill it is proposed to establish an Industrial and Commercial Property Registration Office, at which all inventions, designs and trade marks for which protection is desired must be registered. Special provision is made for the registration of patents, &c., registered or granted by the British Patent Office. Copies of the Bill can be obtained from Messrs. Eason & Co., 40, Lower O'Connell Street, Dublin.

Italian Electrical Imports.—Statistics recently contributed to *Commerce Reports* by the United States Commercial Attaché in Rome, show that Italy imported a total of 14,950 quintals of motors and generators during the first eleven months of 1924, this figure being about the same as those for the two preceding years. The largest supplier was again Germany, although this country's quota (5,699 quintals), was lower than in 1923, and not much more than half of the quantity supplied in 1922. On the other hand the share of the United States rose from 189 quintals to 1,882 quintals. Hungary, which supplied 2,141 quintals as against 3,773 quintals, occupied the second place. Great Britain's share fell from 867 to 242 quintals. In the supply of transformers and unspecified electrical goods, the United States gained at the expense of Germany.

Lead.—Messrs. James Forster & Co. reported on April 28th:—"Demand from consumers is improving, and we consider that the bottom of the recent depression has been reached. . . . Sentiment which was bearish up to a week ago has now veered round and a further recovery in all metals is generally predicted."

An Alternative to the Dole.—Much discussion has been aroused by proposals put forward by Sir Alfred Mond as a more satisfactory means of dealing with unemployment than the unemployment "benefit." Sir Alfred Mond summarised these proposals in a recent letter to *The Times*. They are, briefly, as follows:—Employers, after referring their case to a committee appointed by the Government, would notify the Employment Exchanges of the number of workers whom they could take into employment on full time at full trade-union rates for a definite period in excess of the number employed by them on an "appointed day," which would be fixed by the Government. In respect of 75 per cent. of the men actually engaged in this way, the unemployment benefit of 23s. per week would be handed over to the employer. Unemployed men willing to come under the scheme would be specially marked out for first choice. Firms set up after the "appointed day" would receive the unemployment benefit only in respect of 75 per cent. of half the men employed by them, *i.e.*, 37½ per cent. Moreover, they would have to prove that commitments had been entered into prior to the "appointed day," and, also, would have to commence operations within three months of that day. The scheme would further provide for the gradual reduction of the amount of the grant by six monthly "cuts," and it would automatically end when normal unemployment figures were reached.

Sir Alfred supplements these broad outlines with notes, which include suggestions that the committees should be local organisations similar to the existing unemployment committees, and that, at first, only selected industries should be dealt with under the scheme.

Social Events. — On Friday evening last, Henley's Dramatic Club gave another of their excellent evenings at a large gathering of the London office staff and their friends held at the Crippiegate Institute, Golden Lane, E.C. Sir George Sutton, Bart., the chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd., and Lady Sutton were present. Mr. Percy Rosling, the general manager, was prevented from being present by reason of the serious illness of his son. The Club produced "The Man from Blankley's," a comedy, in which the leading parts were again played by members who have become favourites with those who attend these gatherings. The second act, showing the Tidmarsh's party assembled at dinner, was difficult to see and to follow from some parts of the hall, but the performance did Mr. Henry Thornton, the producer, and the players great credit. Those who devote so much time to the preparation for these occasions deserve high praise for bringing the staff and employés together for relaxation and social intercourse in such a manner.

The Hackbridge Transformer Sports Club (Hackbridge Electric Construction Co., Ltd.), held a successful concert and dance at the Drill Hall, Hersham (Walton-on-Thames), on April 16th. The annual sports of the Club will be held on June 13th.

Coal-Pulverising Plant. — Messrs. Alfred Herbert, Ltd., Coventry, have recently received a further order from the Amsterdam municipal electricity supply authorities for four "Atritor" pulverisers each capable of treating 6,000 lb. of bituminous coal per hour. These machines will fire a Clayton water-tube boiler having a normal evaporative capacity of 154,000 lb. of water per hour to a pressure of 662 lb. per sq. in., and superheated to 375 deg. C. The "Atritors" will be driven in pairs by efficient non-condensing steam turbines, the exhaust steam from these being employed for feed-water heating. The firm has already supplied a smaller machine (4,000 lb. of coal per hour) to the station and one similar to this has also been ordered.

New Australian Company.—The *Industrial Australian and Mining Standard* reports that Siemens (Australia) Pty., Ltd., has been formed in Victoria with a capital of £100 in £1 shares. Its objects are the manufacture of electric wires and cables, scientific instruments, &c.

A Japanese Electrical Exhibition. — *Eastern Engineering* says that the Tokio Municipality is organising an exhibition, for next September, of electric lighting and heating, radio, telephonic and other electrical apparatus.

French Enterprise in Rumania.—A commission composed of French specialists has paid a visit to Bukarest with a view to embarking on electrical undertakings in Rumania. The members of the commission are M. Legouez, president of the Union des Syndicats d'Electricité de France, and MM. Goldschmidt, Guerin and Lescaut, and it first interviewed the Minister of Finance and the Minister of Trade and Industry to obtain information as to railway electrification works and the conditions under which such activity could be carried out. The commission subsequently had an interview with Prof. Mrazec, director of the Geological Institute, who placed before it information concerning the various plans which have been prepared for the electrification of Rumania.

For Sale.—Perth. Corporation Electricity Department invites offers for one Willans 150-b.h.p. compound engine direct coupled to a 75-kW Bruce Peebles d.c. generator. (See our advertisement pages to-day.)

English Lead Production.—A correspondent of *The Times* says that the world scarcity of lead ore has led to a new enterprise in the Peak of Derbyshire. A London syndicate has conducted engineering investigations of the prospects of the Matlock Valley, where there are over 100 lead mines not being worked, and a company is to be formed with a private capital of £100,000 to unwater and work 60 of the mines, some of which have workings under the L.M.S. main Manchester-London railway. Locally there has for years been a tendency to believe that there is wealth in lead ore from the left bank of the Derwent.

New Municipal Showrooms.—The new showrooms and stores erected by the Electricity Department of West Bromwich Corporation were formally opened on April 20th.

A Large Radio Display.—The accompanying illustration is a view of the Clapham premises of Messrs. Alfred Graham and Co. A prominent feature of this comprehensive display is the firm's "Amplion" loud speaker, several examples of which are shown. "Polar Blok" components are also

Messrs. Graham's Radio Display.

exhibited in great variety, and a ship's equipment is to be seen at the left of the background. The show is completed by a number of excellently-finished receiving sets of various patterns, and a display of "Mullard" valves.

Unemployment.—The returns of the Employment Exchanges for the week ended April 13th showed an increase of 38,450 in the number of registered unemployed, the total at that date being 1,204,800.

Manchester Tramway Strike Ended.—After a strike lasting for over a fortnight the maintenance and overhead line-repairing men employed by the Manchester and Salford tramway departments returned to work on April 25th. Their claim was for a weekly increase of 14s., but they decided to accept "under protest" an offer of 8s. per week for the maintenance men and 4s. per week for the linesmen.

American Lamp Case Dismissed.—The United States Government's suit for an injunction against the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company for alleged violation of the Sherman anti-trust laws has been dismissed by Federal Judge Westenhaver at Cleveland. It was charged that the companies controlled the retail price of a certain make of electric lamp. Attorneys for the companies contended that the General Electric Co. possessed the patent rights to make the lamps and that the Westinghouse companies manufactured them as lessees and distributed them as directed by the General Electric Co. Judge Westenhaver held that this practice did not violate the anti-trust laws.—*Electrical World.*

E.D.A. Activities.—At an exhibition of E.D.A. kinematograph films at Australia House on April 17th, there were upwards of 500 electrical men and women in the audience. The films aroused considerable interest which was apparent by the very frequent applause. All the films have been in practically continuous commission in different parts of the provinces during the last few months.

Employment During March.—The April *Ministry of Labour Gazette* states that employment in the engineering industry during March remained bad upon the whole, but continued to show a slight improvement, except in the marine engineering section where it was much worse. In the electrical, motor and cycle, and railway sections, employment was fairly good, but in the heavy engineering section it continued bad.

The detailed analysis of the unemployment figures shows that in the electrical engineering industry unemployment remained stationary at 5.5 per cent., which was very low when compared with the general average for engineering. In electrical wiring and contracting there was an increase of 1.9 per cent.; in electrical cable wire and electric lamp manufacture an increase of 0.2 per cent.; in the gas, water, and electricity supply industries a decrease of 0.1 per cent.; and in the tramway and omnibus services a decrease of 0.2 per cent.

Safeguarding the Radio Industries. — The *Radio Trade Journal* (the official organ of the National Association of Radio Manufacturers and Traders), in its issue for April 18th contains an article, bearing the above title, written by Mr. F. Stacey Hooker, director and general manager of Messrs. C. A. Vandervell & Co., Ltd., of Acton, W.3. Mr. Hooker hopes that radio manufacturers who have been *talking* for a long time about the danger of unfair competition, will now *do* something. The Executive Council of the above Association has the question in hand, and in conjunction with Mr. W. W. Burnham, the chairman, Mr. Hooker is investigating the position and collecting data. The Federation of British Industries is being approached in the hope of securing its sympathy and support in getting the radio trade brought within the scope of the Safeguarding of Industries Act. The writer of the article will welcome, at the address given above, any information as to the offering of goods by German radio manufacturers, and any news of German prices.

British Car for Electricity Department.—The Walsall Electricity Committee proposed to purchase an American motor-car for the electricity department for the sum of £300, but the Town Council, at its meeting on April 20th, decided that a British car should be obtained.

Geneva International Exhibition.—The period of this exhibition has been definitely fixed from September 9th to 20th. Sections are being arranged for radio apparatus, kinematography, phonographic machines, scientific toys, &c.

Lighting and Power Notes.

Bradford.—YEAR'S WORKING.—The statement of the Corporation Electricity Department for the year ended March 31st shows an increase of 1,803,483 kWh sold as compared with the previous year, the total amount of energy sold being 67,905,977 kWh. It is expected in May to test the 20,000 kW turbo-generator now under erection at the Valley Road station, which will increase the capacity of the plant to 64,000 kW.

Colchester.—NEW POWER STATION.—Work has commenced on the erection of the new electricity station, the estimated cost of which is £150,000. It is anticipated that the works will be completed to meet next winter's load. Electricity will be generated at 6,600 V, 3-phase, 50 cycles, and transmitted in bulk to the present station, which will be the main sub-station for distribution. From sub-stations in the outlying districts of the town an a.c. supply will be given. At the present station the current will be converted to d.c. for distribution, and for this purpose the station will be equipped with converting plant and transformers, with the necessary switchgear. The sub-stations will be equipped with static transformers. It is hoped to supply electricity in bulk to neighbouring townships. Steps are to be taken with a view to the Council's obtaining an extension of the area of supply. The total capacity of the new station will be 3,750 kW, as compared with 2,000 kW at present. Provision will be made for the installation of additional plant for the development of the undertaking, and space is set apart for a refuse destructor if the Council decides to adopt one.

Colne (Lancs.).—YEAR'S WORKING.—The accounts of the Town Council's electricity undertaking (engineer: Mr. J. H. Thompson) for the year ended March 31st last record a total revenue of £32,808, as compared with £30,993 in 1923-24. Working expenses amounted to £18,658, as against £20,222, leaving a gross profit of £14,149 (£10,771). After meeting capital charges, there was a net surplus of £2,941, as compared with a deficit in the previous year of £408. The sales of electrical energy rose from 2,569,179 to 2,863,292 kWh.

Dominican Republic.—ELECTRICAL DEVELOPMENT.—According to *Commerce Reports*, work on the Government irrigation projects near Monte Christi and the reconstruction of the Santiago-Puerto Plata electrical plant has begun. The first section of the reconstructed electrical plant at Santo Domingo is now operating.

Frinton-on-Sea.—STREET LIGHTING.—The Urban District Council has decided that, after the expiration of the present contract in September next, the new contract for public lighting shall be divided, the western half of the town to be lighted by the Gas Company, and the eastern half, including the promenade, by the Electric Light Co.

Glasgow.—NEW PLANT.—The Corporation Water Committee has authorised the manager to install an additional turbo-generator in connection with the electrical plant at Stronachlachar.

Hamilton.—ELECTRICITY SUPPLY.—In a report by the Electric Lighting Committee submitted to the Town Council it is stated that the Committee is of opinion that in view of the large decrease in the electricity generated and sold during 1924, the present plant may be capable of dealing with the supply for next winter, and in any case, if a bulk supply is more economical, the Committee has no objection to this proposal. In the circumstances, the Council has agreed to rescind its proposal to extend the plant at the works. The report also states that the Electricity Committee has received a letter from Messrs. Edmundsons stating that they take the view that their contract cannot be terminated until May, 1927. The Town Clerk reports that he has indicated to Messrs. Edmundsons that the Council might take over the undertaking now if suitable terms were arranged. The general manager of the company will shortly be visiting the town and has expressed his willingness to discuss with the Council the question of taking over the undertaking.

Hawarden.—LOAN SANCTIONED.—The Council has been advised by the Electricity Commissioners with reference to its application for sanction to borrow £35,000 in connection with the electricity scheme, that the information supplied by the engineers was not sufficient to enable the Commissioners to deal with the whole of the application, but in order to assist the Council in putting the scheme into operation they are prepared to sanction a loan of £20,000 for mains.

Heckmondwike. — INAUGURATION OF SUB-STATION.—The Urban District Council's new sub-station, which has taken the place of an old steam generating plant, and deals with a bulk supply of electricity to the district obtained from the Yorkshire Electric Power Co., was formally inaugurated on April 25th. Mr. J. J. Lockwood, chairman of the Urban District Council, presided at a public luncheon in connection with the event, and amongst other speakers were Mr. W. B. Woodhouse, Mr. Arthur Ellis, consulting engineer to the Council, and Mr. H. S. Houldsworth. The area of supply of the sub-station is equal to approximately one square mile, with a population of about 9,600, and there are a number of important mills and works in the district. The tramway system within Heckmondwike itself takes its supply from the station. The cost of the scheme was £10,135. Mr. Arthur Webb, of Blackwood, South Wales, was appointed architect, and with the co-operation of the Council's engineer, Mr. W. J. Parrett, the change-over was completed without the slightest hitch. The contract with the British Thomson-Houston Co. included the provision of:—(1) H.p. switchgear; (2) transformers and rotary converters; (3) l.p. switchgear. The h.p. switchgear controlling the incoming 3-phase a.c. supplies at 10,000 V is of the cubicle draw-out type, comprising eight panels, three of these being the property of the Yorkshire Electric Power Co., and five being the property of the Council. The company's panels include two feeder units and one main metering unit, the remaining five panels of the Council consisting of one metering panel and four transformer panels for the rotary converters. There are four 300-kW rotary converters, each having a separate transformer (of the British Electric Transformer Co.'s manufacture). The rotary converters are designed to run at 1,500 r.p.m., and to give 572 amps. as shunt-wound, three-wire generators, at 460/508 V for lighting, and 545 amps. as compound two-wire machines at 500/550 V for traction purposes. They are provided with overspeed and end-play devices, and are fitted with self-synchronising starting motors. The transformers are designed to give 330 kVA at 9,750 volts, having a frequency of 50 cycles. The l.p. switchgear for controlling the supplies to the distribution system and tramways consists of a ten-panel, 460- and 550-V, two- and three-wire board, built up of black enamelled slate panels.

Horsham.—YEAR'S WORKING.—The report on the working of the Urban District Council's electricity undertaking (electrical engineer, Mr. F. Ffrench) for the year ended March 31st, 1924, records a total revenue of £12,652, as compared with £10,252 in the preceding year. Working expenses amounted to £5,929, as against £5,362, leaving a gross profit of £5,907 (£3,999). After deducting capital charges, there remained a net surplus of £2,156, as compared with £1,025 in 1922-23. The sale of electrical energy amounted to 575,574 kWh, an increase of 40 per cent., and the average price obtained per kWh fell from 5.74d. to 5.10d. The maximum supply demanded rose from 363 to 426 kW.

Huddersfield-Halifax.—INTERCONNECTION SCHEME.—At a recent meeting of the Huddersfield Town Council provisional terms of agreement between representatives of the Huddersfield and Halifax Corporations as to the linking-up of the power stations, as recently suggested by the Electricity Commissioners, were submitted to the Council. The electrical engineers of both towns have been requested to prepare specifications for the cables and sub-station equipment. A Huddersfield sub-committee has been given power to continue negotiations with Halifax and to conclude a formal agreement.

Leeds.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Corporation to supply electricity in the township of Alwoodley and part of the township of Adel-cum-Eccup.

London.—ST. PANCRAS.—The Borough Council has received sanction to loans of £21,340 for mains and services, £3,500 for meters, and £1,500 for domestic apparatus to be let out on hire.

STOKE NEWINGTON.—The extension of the electricity works will be formally opened by the Mayor on May 28th.

HAMMERSMITH.—The Electricity Committee has recommended to the Borough Council that electric cookers be installed in the Council's houses on the Wormholt estate. It is suggested that a rental charge at the rate of £2 10s. per annum (variable according to the type of cooker adopted) be made, the energy to be supplied at a fixed charge of 10 per cent. of the rateable value of the premises, plus a flat rate of 1d. per kWh.

Marlborough.—LOAN.—The Town Council has applied for sanction to a loan of £2,425 for mains, meters, and services.

Northern Ireland.—DONEGAL.—Mr. John Goode, Letterkenny, has informed the Donegal Asylum Committee that it is proposed to float the Donegal Electric Lighting and Power Co. and utilise the water resources of the River Lennan. He asked if the Committee would take an interest in the undertaking, and pointed out that the county was not included in the plans for partial development of the Shannon scheme. The Committee has decided to take no action in the matter, and is to proceed with the installation of generating plant in the asylum at a cost, including wiring, of £2,560.

Paignton.—PURCHASE OF UNDERTAKING.—The Urban District Council is negotiating with the Electricity Commissioners on the question of the proposed purchase by the Council of the local electricity undertaking.

Plymouth.—LOAN SANCTIONED.—The Corporation has received sanction to a loan of £24,745 for mains, transformers, and switchgear in connection with the extensions on the North Prospect estate.

MAINS EXTENSIONS.—The Council has approved extensions of mains at an estimated cost of £4,068.

Portsmouth.—SYSTEM OF SUPPLY.—The Electricity Committee is applying to the Electricity Commissioners for sanction to adopt the following systems of supply in any part of its area:—(1) Three-phase, 50 cycles, 415 V between phases, 240 V between phases and neutral; (2) single-phase, 200 V, 50 cycles.

LOANS SANCTIONED.—Sanction has been received to the borrowing of £12,000 for transformers and sub-station equipment, and £11,500 for the provision and laying of an e.h.p. main.

ELECTRICITY IN BULK.—Application is being made for sanction to erect transmission lines in connection with the bulk supply to Fareham and Chichester.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

TUAM (Co. GALWAY).—*The Tuam Electricity Co.*—Lighting: From 1s. to 10d. per kWh. Power: From 6d. to 4d. per kWh. Meter rents: From 1s. to 6d. per month.

SHOREDITCH.—Lighting: From 5½d. to 5d. per kWh. Power: From 1½d. to 1¼d. per kWh.

Preston.—ELECTRICITY AGREEMENTS.—The Town Council has been recommended by the Electricity Committee to approve an agreement with the Lancashire Electric Power Co. for a bulk supply by the Corporation to Leyland and Walton-le-Dale, and an agreement between the Corporation and the company granting the latter an easement to lay three cables along the land of the Corporation from the Ribble Power Station to Fish House Bridge in connection with the supply to the company. It has been reported to the Electricity Committee that the Power Co. has agreed that the districts of Howick, Hutton, Much Hoole and Little Hoole, with Longton, should be left to the Preston Corporation to develop, and the Committee has decided that the application of the Corporation for a Special Order for extending its area of supply should be limited to these townships.

The Electricity Committee has received sanction to the establishment of the Preston portion of the main transmission line between Blackburn and Preston.

Rochdale.—LOAN SANCTIONED.—The Gas and Electricity Committee has received sanction to the borrowing of £27,414 for mains and services.

Southend.—AN EXAGGERATED REPORT.—It was freely reported in the lay Press last week that a total breakdown of electricity supply in the town had occurred on April 20th. Mr. Birkett, the borough electrical engineer, informs us that the matter was nothing more serious than a short-circuit on a service cable which blew the fuse on one side of the three-wire system. The result was the extinguishing of the lighting in alternate buildings on the sea front for a distance of 500 yards. The fault was repaired in two hours.

Turkey.—ELECTRICAL DEVELOPMENT.—The Government is reported to have recently granted a concession to a syndicate for the establishment of a central power station and an electric tramway in the town of Adana.

Whitchurch.—ELECTRICITY SUPPLY.—The Urban District Council has decided to oppose the application by the Gwynedd Trust for an Order to distribute electricity in the district. The supply is to be brought into the town by the North Wales Power Co., and the Council has promised to support the Whitchurch Gas Co., which proposes to distribute the supply.

Withnell.—ELECTRICITY SUPPLY.—The Urban District Council proposes to obtain an electricity supply for the Withnell and Brinscall districts, and inquiries as to terms are being made of the Blackburn, Chorley, and Darwen Corporations.

Wolverhampton.—ELECTRICITY EXTENSIONS.—The following electricity extensions were approved by the Corporation on April 20th:—

Supply to Featherstone and Hilton Districts.—It has been decided to commence the development of the supply in the Featherstone and Hilton districts by the laying of an e.h.p. 6,600-V feeder cable from the 33,000/6,600-V sub-station erected at Hilton to a point in Featherstone, at which a 6,600/400-V sub-station will be built, and to lay approximately five miles of distributor cables from this sub-station to supply some 450 houses and some miles of street lighting. The estimated cost of the work now authorised is £8,812.

Supply for New Factory.—In order to give a supply for a large new factory now being built in Wolverhampton, which will require some 10,000,000 kWh per annum, it has been decided to lay two 6,600-V feeders from the Commercial Road generating station to the factory site, which, together with the necessary e.h.p. switchgear, is estimated to cost £15,300.

Extension of Generating Plant.—On account of the rapid development work in the outside districts supplied by the Corporation, extra supplies are required at Cannock, and on account of increased requirements in the town itself, it has been decided that two old turbo-generator sets at the Commercial Road generating station shall be disposed of immediately and replaced before next winter by a 7,500-kW set, and £44,000 has been sanctioned for this work by the Town Council, which has also approved the complete duplication of a similar plant just completed.

Extension of Distribution Mains.—The Council has authorised various distribution mains extensions in the town at an estimated cost of £2,120.

Tramway and Railway Notes.

Bradford.—RAILLESS CARS.—The Corporation Tramways Committee, to which the City Council recently referred back its proposals for the change over from railled tramways to the railless-car system on the Idle and Thackley routes instead of relaying the rails, has re-affirmed its recommendation.

Continental.—FRANCE.—Work in connection with the electrification of the Bordeaux-Hendaye railway is proceeding rapidly. The group of hydro-electric works in the Ossau valley, situated at Artouste, Miegebat and Hourat, will supply the bulk of the energy necessary for the working of the line. Raised at first to a pressure of 150,000 V at the Hourat transformer station, the electrical energy will be conveyed to the receiving centres at Dax and Pessac, near Bordeaux, by means of a double transmission line. The current, stepped down at Dax and Pessac to 60,000 V, will then be brought into contact with the railroad by means of a device consisting of metallic supports in the form of an arch, which will support on their upper part the 10,000-V line for the lighting and operation of the stations and, on their lower part, the 60,000-V line for feeding the sub-stations and the two continuous current contact lines of 1,500 V. The electric trains will be drawn by locomotives of from 2,100 to 3,200 h.p. Their maximum speed will be 120 km. per hour and their commercial speed 100 km. The opening of the Bayonne-Hendaye section is expected on July 1st next, but the line from Bordeaux to Bayonne will not be completed until the beginning of next year.—*Reuter's Trade Service* (Paris).

BELGIUM.—Plans have been completed for the extension of the Ostend-Westende electric railway as far as the French frontier.

Guatemala.—STREET RAILWAY CONTRACT LAPSED.—The Department of the Interior (Ministerio de Fomento), Republic of Guatemala, entered into a contract with a Belgian firm on January 28th, 1923, for the establishment of an electric street railway system in Guatemala City. In view of the fact that more than the stipulated time has passed without the required deposit of $15,000, the President of the Republic has resolved to declare the contract lapsed.—*Commerce Reports.*

Keighley.—EXPLOSIONS.—A series of explosions from inspection boxes recently occurred. Three or four steel and concrete covers and the base of a tram standard were lifted and the whole of the railless services in the town were stopped for two hours. The service was resumed, but after a short time another series of explosions, followed by a gas flame from two of the inspection boxes, occurred. The feeder for the railless service was again affected and the cars were stopped for the day. The flames continued from the boxes until the cable ducts were flooded. When an inspection was made it was found that a hole some inches long had been fused in a four-inch gas pipe, which had been almost touching an old metal covering for a cable duct. A h.p. cable had fused and had affected the railless feeder.

London.—METROPOLITAN DISTRICT RLY. CO.—The Minister of Transport has recently made the following Order:—The Ministry of Transport (Metropolitan District Railway) Order, 1925, authorising the acquisition by agreement of certain lands in the parish and urban district of Brentford, and the construction of works by the Metropolitan District Railway Company and matters incidental thereto.

NEW ESCALATORS.—By the end of the year, 16 new escalators will be operating at various underground stations. They will all be of the new "Cleat-comb" pattern with the exception of that at Tottenham Court Road.

Sheffield.—NEW ROUTE.—The Town Council has received the consent of the Minister of Transport to the construction of a tramway from Park Lane to the junction of Retford Road and Carr Lane. A double track will be laid, and the route will be over a mile in length.

New Zealand.—Wellington.—The municipal tramway returns for the last financial year show that, after providing for the ordinary special expenditure and capital charges, amounting to £78,438, the net credit balance was £12,754. One million and a-half more passengers were carried.—*Reuter* (Wellington, N.Z.).

Telegraph and Telephone Notes.

European Telephony.—United Control.—The League of Nations is showing interest in the movement for international control of the European telephone system, and the *Morning Post* has reason to believe that the League would like to assume that control itself. The project was first discussed two months ago at Geneva towards the end of Viscount Cecil's last visit. A few weeks ago, when Lord Parmoor was in Geneva, a special committee was formed to go into the matter in detail. Communications have passed between the League and the British Post Office.

Empire Radio Communication.—P.O. Policy.—At the annual conference of the Post Office Controlling Officers' Association at Plymouth, which was attended by some 150 delegates, Mr. D. Grant, of Edinburgh, pointed out in his presidential address that far-reaching changes with regard to the wireless service were under consideration, and strong criticism was being levelled at the Department's treatment of the Empire problem. Nothing was more calculated to arouse distrust outside than the suggestion that the wireless service was not important enough to form a separate branch. A bold, generous, and enterprising policy was desirable, because parsimony in a matter so vital must mean failure. Reconstruction and maintenance as a distinct department was the only way in which Empire wireless could be made the premier wireless service in the world.—*The Times.*

Irish Free State.—Telephone Rates.—Amongst the proposals of the Irish Free State Budget, which was introduced to Parliament by the Finance Minister, Mr. E. Blythe, on April 22nd, is the reduction of the telephone rental fee for private houses from £7 10s. to £5.

New Atlantic Cable.—British Project.—Preparations are being made for the laying next year of a new cable between Penzance and New York, *via* Newfoundland. This is Britain's reply to the proposed German cable from New York to Germany, says the *Daily Mail*, and the British cable will be capable of taking about 2,500 letters a minute in one direction only, or 500 words a minute more than is possible in the first section of the German cable that has been laid between New York and the Azores.

Pacific Cable.—Duplication.—Contracts have been completed for the duplication of the northern sections of the Pacific cable. The Telegraph Construction and Maintenance Co., the contractor for the Banfield-Fanning section, 3,450 miles of loaded cable, is to employ the new alloy, "Numetal." Siemens Brothers, the contractors for the Fanning-Suva section, 2,043 miles of loaded cable, are using "Permalloy." The cost of the two sections will be £2,379,000, and completion is due in September, 1926.

It is estimated that the speed of Permalloy cable is 600 letters per minute and of a Numetal cable 720 letters, both simplex, as compared with the present rate of 135 letters, duplex. It is anticipated that duplex operation will be found possible.

The reserve fund of the Board, which was £2,100,000 in February, will be increased to £2,450,000 by the time duplication is completed. A condition of the contracts is that all the components shall be of British origin, except certain loading material, which cannot be guaranteed British. — *Daily Telegraph.*

Rhodesia.—New Radio Station.—The Government of Southern Rhodesia has definitely decided to go ahead with the scheme for a radio station just outside Salisbury, for which £12,000 has been set aside under the loan estimates to cover the cost. Tenders will be called for in a few months, according to *Commerce Reports.*

The Telephone Service.—New Exchanges.—The automatic telephone system is being steadily spread from the city of Leeds to the suburban stations, and the four sub-exchanges now being converted are those at Roundhay, Chapeltown, Headingley, and Stanningley. The contemplated new telephone exchange at Keighley, on the change-over to the automatic system, will be erected on the Old Rectory ground; it will not be complete until 1927.

Development.—During the year ending March 31st, 1924, the number of telephone stations in the United Kingdom rose to 1,158,492, an increase of 107,820 or 10.3 per cent. The stations in the London area numbered 410,861, and those in the provinces 747,631, of which 51,489, or about 7 per cent., are in the Liverpool district. The private residence telephones increased to 186,684, a net growth of 32,056, or 21 per cent. The residence rate subscribers represent 16 per cent. of the total telephones. The total number of telephone stations working at the end of December, 1924, was 1,243,621, an increase of 85,129, or 7.3 per cent. for nine months, or at the rate of 9.7 per cent. per annum. At the end of December the private residence telephones had risen to 212,314, or at the rate of 18 per cent. per annum.

Radio Notes.

Amateur Radio Union.—Paris Congress.—The first congress of the newly-formed International Amateur Radio Union was held in Paris from April 14th to 19th, 21 countries being represented. Mr. Hiram Maxim was appointed international president, Mr. Gerald Marcuse vice-president, and Mr. K. B. Warner secretary-treasurer. The Congress decided, by an almost unanimous vote, to adopt Esperanto as the international auxiliary language.

The juridical section of the Congress dealt at length with composers' and authors' rights, and voted unanimously the two following resolutions:—

1. The right of intellectual property recognised by the International Convention applies to the diffusion of all intellectual works by all means of transmission and execution. It is therefore applicable, with all the consequences ensuing from its application, to works transmitted by radio-electricity. 2. The radio-electric transmission of the execution of an intellectual, literary, or artistic composition cannot be made without the consent of the person interpreting the composition.

The Congress also discussed the confusion caused by similarity of wavelengths and approved a series of recommendations by which specific wavelengths would be assigned to amateurs in different regions. Mr. Hogg (Great Britain), the reporter of the sub-committee appointed to deal with this aspect, said that the committee considered it was advisable to divide the world into four distinct sections: Europe, Canada, and Newfoundland, the United States, and the rest of the world. In principle, only wavelengths exceeding 70 metres had been dealt with, as there was as yet insufficient data with regard to shorter lengths; nevertheless, provisional figures for shorter lengths had been determined in order that experiments should be carried out in an orderly manner. The lengths decided upon were as follows:—

Europe.—115-95 metres; 75-70; 47-43.
Canada and Newfoundland.—120-115 and 46-41.5 metres.
United States.—85-75 and 41.5-37.3 metres.
The Rest of the World.—96-85 and 37.5-35 metres.

All other wavelengths, apart from those now indicated for amateurs and those already chosen for international traffic, should be set aside for experimental purposes.

Australia.—Licence Fee Reduction.—On July 1st the Federal Government will reduce to 30s. the fee for a licence, and the director of postal services, Mr. Brown, has indicated that towards the end of the year the Government will consider a reduction in the percentage of the fee which the Postmaster-General's Department claims for itself. Since the Postal Department instituted legal proceedings against listeners who failed to pay the licence fees, the number of licences issued in Victoria has increased by 95 per cent., and now totals about 13,190.

Musicians' Claims.—Fees and Rights.—When a song is sold the author and publisher get their shares of the profits, and at a concert the public pays to hear it, but when the song is broadcast listeners contribute nothing. To set matters right the Performing Rights Society of Britain now issues licences for rights to perform and to broadcast, and the payments are divided in recognised proportions between the author, composer, and publisher. Hitherto the arrangement has been confined to Great Britain, but there are places abroad where music has been broadcast free. Therefore, a representative of the Society recently paid a visit to South Africa, and made an arrangement with the parties concerned.

Australia.—In the recent musicians' dispute at Melbourne it was contended, on behalf of the union, that while broadcasting increased the number of the audiences attracted and increased the profits, the musicians engaged were not receiving any additional payment. Argument on behalf of the employers was to the effect that the musicians were not required to do additional work for the purposes of broadcasting.

Sweden.—Following the composers' example, says the *Evening News*, the Swedish Authors' Union has approached the managers of the Swedish radio service with a view to compensation when their works are broadcast.

Norway.—Actors employed by the Oslo (Christiania) theatres have been forbidden to work for broadcasting companies, says the *Evening News*, and the managements also refuse to allow theatre performances to be transmitted. The secretary of the National Theatre declares that "as long as broadcasting companies think they can get everything for nothing" the theatres will not change their attitude.

Oscillation.—Interference with Aircraft.—During the recent flight of R 33 communication between the airship and the Croydon and Pulham aerodromes was seriously impeded by oscillation from radio receiving sets. The consequences which might result from interference with communication with aircraft in danger are very grave, and the Postmaster-General warns the owners of receiving sets that the use of reaction to such an extent as to cause interference is an offence which directly contravenes one of the conditions of their licences and renders the licence subject to withdrawal.

United States.—Amateur Transmitters.—Amongst its membership the American Relay Radio League includes 18,000 amateurs who are licensed to transmit.

An Electrically-Driven Linen Mill.

Messrs. Alexander's Canmore Works, Dunfermline.

THAT substantial economies are achieved by electrically driving weaving and spinning mills is proved, if proof is needed, by the fact that one electrical manufacturing firm alone claims to have installed in such mills plant aggregating over 250,000 h.p.

Just over a year ago Messrs. James and Thomas Alexander, Ltd., notably improved their Canmore factory by converting it from steam to electric driving. This is an entirely new departure so far as Dunfermline is concerned, but the success of the venture, which was carried out under the supervision of Messrs. R. D. Munro and George Ness, consulting engineers, of Glasgow, is indicated by the fact that during the 14 months that the new plant has been in operation no hitch whatever has been experienced, and the results have given entire satisfaction. Amongst the advantages which electrical operation affords may be mentioned increased production as a result of the higher speed of operation; the steadier drive reduces the number of stoppages necessary to repair broken threads and, consequently, better fabric is produced, whilst the employés greatly appreciate the absence of the noise formerly created by heavy gearing and long pulley shafts.

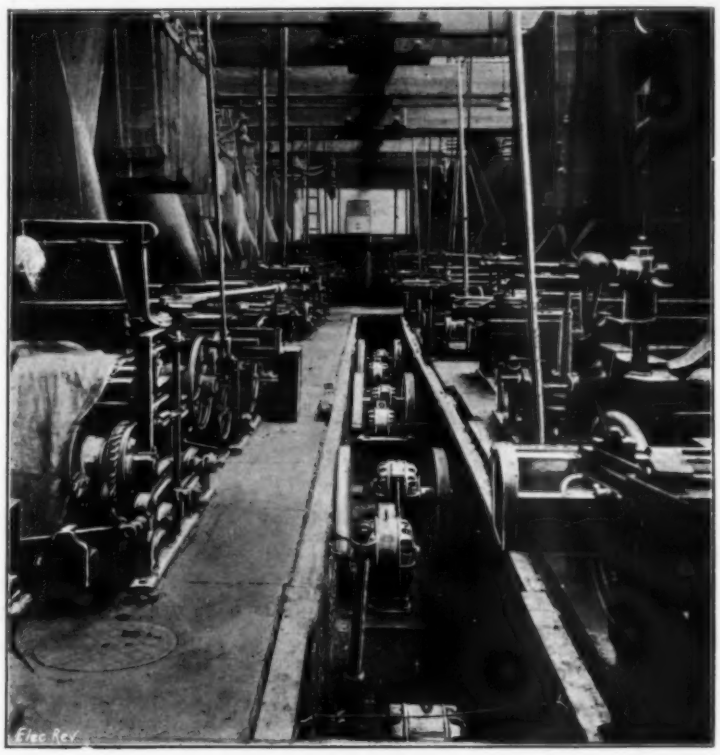


Fig. 1.—Weaving Shed: Loom Motor Pit.

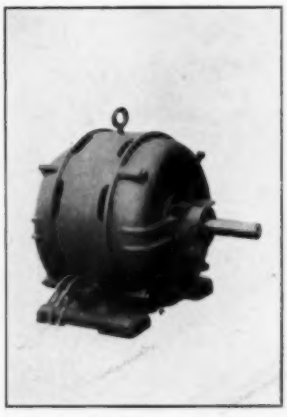
of the space occupied by the old steam plant is now being utilised for other purposes; one boiler has been retained for heating and drying purposes, and only about 1/16 of the space formerly occupied by the steam plant is needed for the accommodation of the electrical plant.

Many difficulties had to be faced when the conversion was undertaken, and it is interesting to note that the change-over was satisfactorily accomplished in the 10 days during which the factory was closed for the New Year holidays. This is a notable achievement, for it was necessary to use oxy-acetylene plant to cut out some of the shafting, and many of the heavy bearings had to be actually removed by blasting.

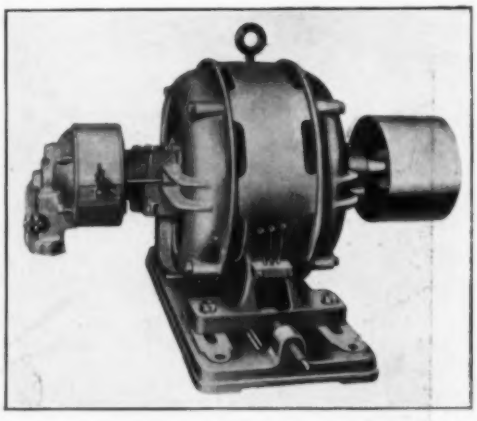
Moreover, the ability to shut down any section or group of looms without affecting the rest of the mill is often economical and convenient. For instance, the looms that produce linen embodying a complicated pattern, such as the table cloth illustrated in fig. 8, can be allowed to remain idle for a time in the hope of a repeat order being secured, thus saving the cost of dismantling and re-setting the card system for weaving the pattern.

Electricity is delivered by the Fife Electric Power Co.

Squirrel-cage 7½-h.p. Motor.



Squirrel-cage 12½-h.p. Machine.



Slip-ring 16-h.p. Motor.

Figs. 2, 3, and 4.—Typical Metropolitan-Vickers Motors.

Electric driving has eliminated the former, and the adoption of sectional driving has necessitated the retention of the lighter short lengths of shafting only. A reduction in the amount of power needed has resulted, and less lubrication has meant greater cleanliness. Much at 6,600 volts, 3-phase, 50 cycles, to the factory substation, where the pressure is reduced to 440 volts. Fig. 7 illustrates the Ferguson, Pailin h.p. switch cubicles and the transformer, supplied by the Hackbridge Electric Construction Co., Ltd., while Fig. 6

shows a portion of the 1,191-mfd. condenser on the left and George Ellison l.p. switchgear.

The transformer steps down from 6,600 to 440 volts for the general supply, but is arranged with an extension of its l.p. winding to give 600 volts for the connection of the static condenser, the combination being covered by the Dorey overwinding patent No. 177,024. The transformer, so far as the ratio 6,600/440 V is concerned, is standard, rated at 200 kVA (both primary and secondary), and the provision of the overwinding does not involve an increase in the rating of its primary winding, as this winding is loaded with the vectorial sum of the 440-volt general load and the condenser load, so that the only extra cost involved is that of the addition of a few turns on the low-pressure winding to give the 600-volt tapping; the copper section of these turns corresponds to the output of the condenser.

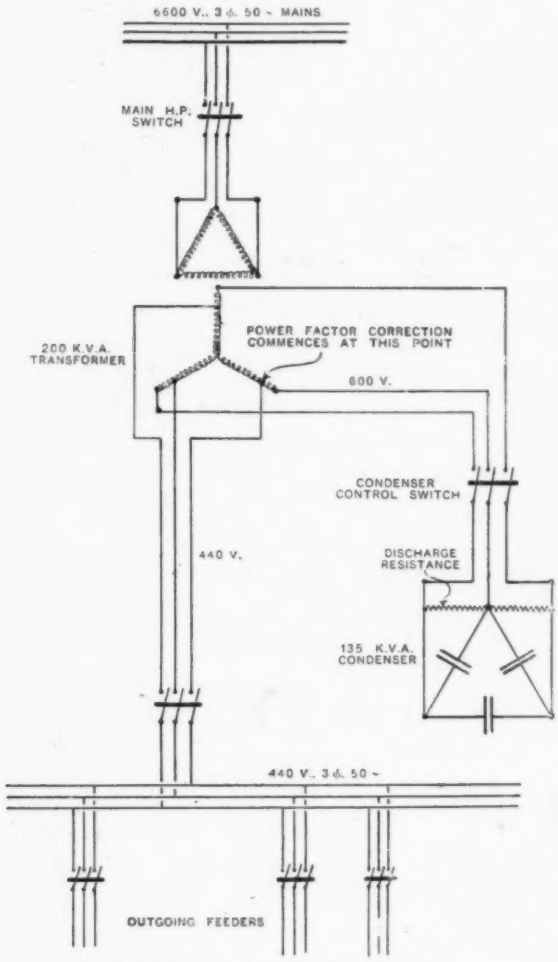


Fig. 5.—Transformer-Condenser Connection Diagram.

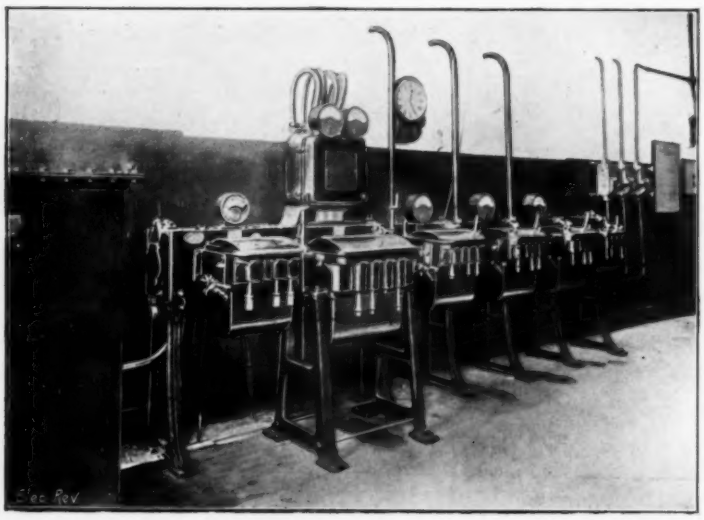


Fig. 6.—Condenser and L.P. Switchgear.

We stress this point as the overwinding patent is in some cases misunderstood, and it is thought that an increase in the primary output is involved, but in effect the arrangement is similar to the results that would be obtained by connecting a condenser through an auto-transformer to the 440-volt supply, but with the overwinding the auto-transformer is eliminated. Avoiding the auto-transformer reduces the overall losses materially, as the additional losses with the overwinding are the copper losses in the extension of the winding only, and a very slight increase in iron losses.

The condenser has an output of 135 kVA when working at 600 volts, three-phase, 50 cycles, and is of the standard oil-immersed tank type built by the Telegraph Condenser Co., Ltd., fitted with self-contained high-resistance discharge coils permanently connected across the condenser terminals inside the tank, which effectively discharge the condenser on switching out or in the event of a failure of the supply.

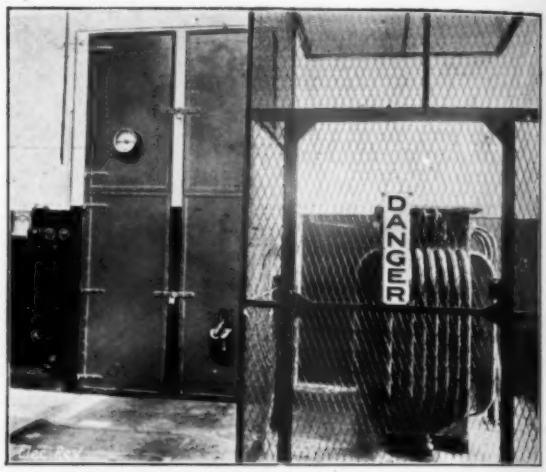


Fig. 7.—H.P. Switch Cubicles and Transformer.

The accompanying diagram shows the method of connecting up the installation. The transformer is controlled by an oil switch on the primary side, and a 440-volt oil switch on the secondary. The condenser connections are taken straight from the 600-volt terminals on the transformer through an oil switch fitted with three overload releases and an ammeter, and the condenser was ordered to correct a 70-kW load from 0.46 to unity. It is reported by the consulting engineers that the power factor, depending on the load, varies from 0.95 to 0.98, as the load has increased considerably, and they have expressed themselves as entirely satisfied with the equipment. A number of installations working under this overwinding patent in Great Britain are giving every satisfaction.

Fig. 8.—Bleached Double Damask Cloth.

The 43 motors driving the factory machinery were supplied by the Metropolitan-Vickers Electrical Co.,

Ltd., and total 298½ h.p. The smallest is of 1 h.p. and the largest of 17½ h.p.; figs. 2 to 4 illustrate typical machines, and all, except one of the largest, are of the squirrel-cage, 440-V, 710-r.p.m. type, controlled by Ellison oil-immersed star-delta starters. In the weaving shed there are 26 motors of 7½ h.p. and four of 3 h.p. for driving the 531 looms, most of them being located under the floor, as shown in fig. 1, the pit having originally accommodated the belt-driven shafting. Each motor drives a length of loom shafting through Hans Renold chains, running in oil baths.

The weft- and warp-winding departments are driven by 17½- and 12½-h.p. motors respectively, as shown in fig. 11. In this case both the motors are provided with Broadbent centrifugal clutch pulleys in order to facilitate starting. The warping plant is driven by a 3-h.p. motor, whilst the warp-dressing room is provided with a 12-h.p. machine, and the card perforating and stitching machines are driven by a 3-h.p. motor. The calender, which is shown in fig. 14, needs two motors, and the main 16-h.p. chain-drive machine is the only slip-ring motor in the works. It is a 480-r.p.m. motor (fig. 4), with an Ellison tramway-type controller for reversal and speed variation. The rollers are steam heated, and emergency push-buttons enable the calender to be stopped from any position. A 6-h.p. motor drives the weight-adjusting apparatus and pump.

The first and second cropping machines, fig. 10, are fitted with 3- and 5-h.p. motors and chain drives respectively; the folding and measuring machine is driven by a 3-h.p. motor, and emergency stops are included in these cases also. Fig. 12 illustrates the sewing machine section, which demands 3 h.p., the machines being of the Willcox & Gibbs S.M. Co. and Singer patterns. Fig. 12 is also a view in the ironing department, where gas-heated irons have been abolished in favour of "Creda" 230/250-V, 3.1-A electric irons, resulting in more efficient work and much healthier working conditions for the operators.

A 6-h.p. motor suffices for the fitters' machine shop, with the addition of an electric blower of 1 h.p. for the smiths' forge.

Advantage was taken of the re-organisation to introduce electric lighting in place of high-pressure gas, and figs. 12 and 13 are views of the same room under the new and old conditions. The lighting load is equally distributed between the three phases and neutral, there being three main 220-volt circuits with Parmiter, Hope and Sugden "Fluvent" 50-A d.p. switches leading to the distribution boxes. Plugs have been provided for the use of portable lamps with v.i.r. cables. General lighting is provided in most rooms, but in special cases individual lamps are located over the machines, and the looms have two lamps each. Much better light has been obtained on the fabric surface, and the setting up of cards has been facilitated by the ability to swing the lamps from side to side, which was impossible with gas lighting. The lampholders are all shock-proof, being made entirely of insulating material, and the danger of fire has, of course, been practically eliminated. For lighting gas lamps the use of a naked flame is unavoidable, while the rigid piping makes it very difficult to adequately illuminate the intricate card and cord arrangements at the top of the looms by means of gas. The wiring installation was carried

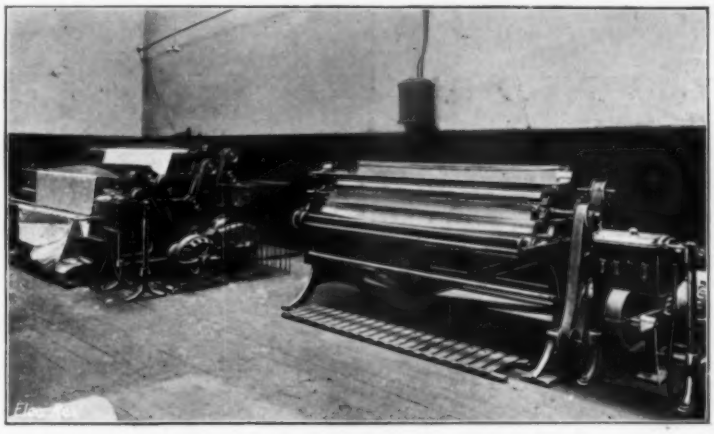


Fig. 10.—First and Second Cropping Machines.

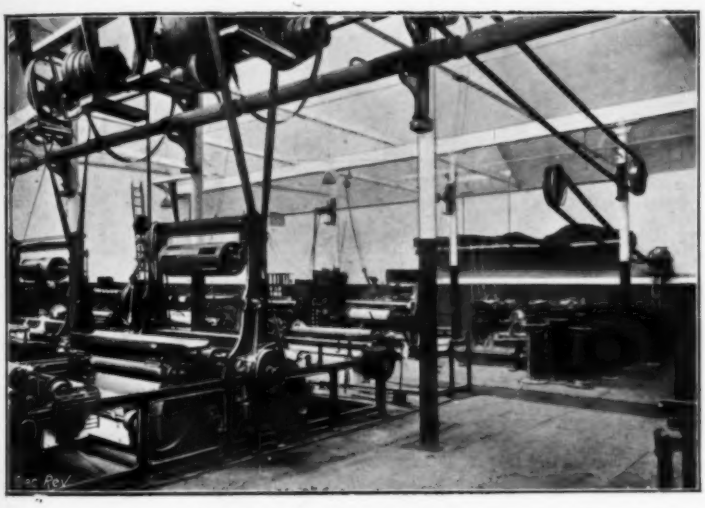


Fig. 9.—Part of the Warp Machinery.

Fig. 11.—Warp- and Weft-winding Plant.

out by Mr. John Brodie, of Dunfermline. Everything is ironclad, and the wiring throughout is run in screwed-steel Simplex conduit, the separate earthing system being particularly good, as the conduit is not relied upon for this purpose. The conduit is continuous throughout, being adequately screwed into

Fig. 12.—Electric Ironing Section and Electrically-driven Sewing Machines.

every switch and terminal box. The installation is an excellent example of its kind, and has not been spoiled, as is done in too many cases, by leaving short lengths of cable exposed at the machine terminals and switch boxes.

In conclusion, we have to express our indebtedness to Mr. J. Alexander and Mr. J. P. Beveridge, managing director, for the facilities placed at our disposal on the occasion of our visit to the mill, which left the impression of a good job well done.

The mill owners are to be congratulated upon the manner in which they assisted the consultants to demonstrate what can be achieved in the way of increasing the efficiency of operation of such a factory by the adoption of electric power and lighting. It should be

Fig. 13.—Example of Old Gas Lighting.

pointed out that by installing all the wiring and placing much of the electrical gear in position prior to the actual change over, it was made possible to carry out the conversion without in any way hindering the productive capacity of the plant.

The wisdom of providing apparatus to improve the power-factor of such installations is appreciated, and the satisfactory results obtained in this instance are worthy of notice. They enable the power suppliers to offer a favourable tariff and the consequent reduction in power costs materially helps towards the redemption of the extra capital expended on the power-factor correcting plant.

For the last year or two, the linen trade in Dunfermline has not been in an exactly flourishing condition, but the work outlined above is an indication of the optimistic view that is taken of prospects, and Messrs. Alexander's example of preparation for the future should be an inducement to other local manufacturers to follow suit.

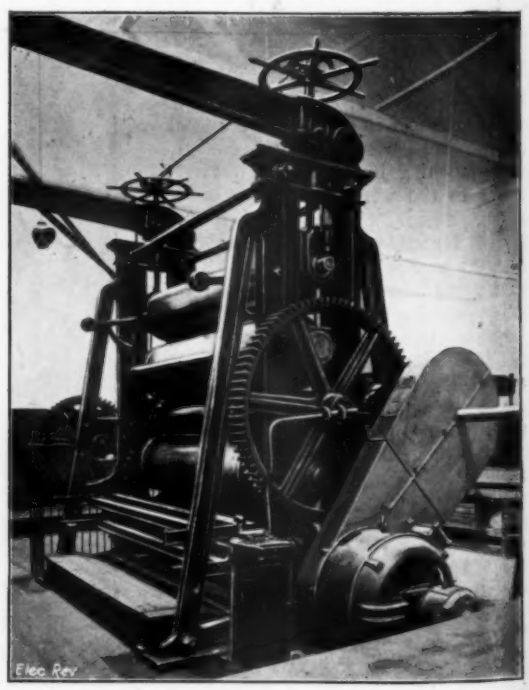


Fig. 14.—Electrically-driven Calender.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—SYDNEY.—July 8th. New South Wales Government Railways. Two coal elevators and the maintenance of the whole equipment for 12 months.*

MELBOURNE.—June 3rd. Victorian Government Railways. Supply of 2,200-V cable and spares.—*Reuter's Trade Service* (Melbourne).

Ashton-under-Lyne.—May 20th. Watch and Town Hall Committee. Rewiring the electric light installation at the Town Hall. Specification from Borough Electrical Engineer, Electricity Works, Wellington Road.

Ayrshire.—Education Authority. Electric light installation at Catrine Public School. Plans from Mr. R. Armour, 38, Bank Street, Kilmarnock.

Belgium.—The Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels, are inviting tenders, until May 6th, for the supply of a quantity of bare and insulated cables and wire. Particulars (Cahier des Charges Special No. 4-208) for 3 fr. 80 c.

May 12th. Commune de St. Gilles, Brussels. Armoured cable and bare copper.*

Bournemouth.—May 21st. Tramways Department. Two 750-kW geared turbines and d.c. generators, complete with condensing plant. (April 17th.)

Bridlington.—May 14th. Electricity Department. Supply of two electricity feeders. (See this issue.)

Bristol. — May 12th. Electricity Department. Two water-tube boilers complete. (April 17th.)

Cardiff.—May 20th. Rural District Council. Switchgear equipment and e.h.p. and l.p. cables. (April 24th.)

Dundee.—May 18th. Tramways Committee. Stores, including armature coils, commutators, mica, &c., insulated wire, lamps, switches, materials for overhead equipment, &c., for 12 months. Specifications from general manager.

Edinburgh.—May 13th. District Board of Control. Electric lighting and heating at new ward building, Bangour Mental Hospital. Schedules from Mr. Jas. D. Gibson, surveyor, 60, Frederick Street, Edinburgh.

May 8th. Education Authority. Electric lighting installation at extension to Tynecastle School, M'Leod Street. Executive Officer.

Egypt.—CAIRO.—July 1st. Public Works Department. Electrical pumping plant for a floating dock.*

Erith.—May 11th. Urban District Council. L.p. cables. (See this issue.)

Falkirk.—Corporation. Works, including electric lighting, in connection with housing scheme. Mr. W. Gibson, Director of Housing, Arnotdale, Falkirk.

Gillingham.—May 9th. Electricity Department. Two 625-kVA, 3-ph. static transformers, two 11,000-V, 3-ph. mains, one regulating transformer, e.h.p. and h.p. 3-phase switchboard. (April 24th.)

Glasgow.—May 5th. Tramway Department. Materials, including brake blocks (chilled iron), castings, ironmongery, iron and steel bars, plates, &c., rubber and asbestos goods, springs, &c., for 6 or 12 months. Specifications from manager.

May 16th. Electricity Department. L.p. and e.h.p. cables, small I.R. cables and flexibles, meters, and carbons for 12 months. (See this issue.)

India.—May 22nd. India Store Department. Carsack elements for Leclanché cells. (See this issue.)

London.—METROPOLITAN ASYLUMS BOARD.—May 20th. General engineering work, installation of four new Lancashire boilers, fuel economiser, brickwork settings, laundry machinery and plant, electrical generating plant, motors, and power wiring at the Leavesden Mental Hospital, King's Langley. (April 17th.)

Manchester.—May 6th. Education Committee. Electric lighting installations at Peacock Street Municipal school, West Gorton. Specifications from Director of Education, Deansgate, Manchester.

New Zealand.—WELLINGTON.—June 9th. Post and Telegraph Department. Metallic two-wire plugs for telephone switchboards.*

Raworth.—May 16th. Electricity Department. Paper-insulated cables, e.h.p. and l.p. switchgear, and transformers. (See this issue.)

South Shields.—May 22nd. Electricity Department. Two groups of Scott connected transformers, each 1,250 kVA, also h.p. switchgear. (See this issue.)

Stoke-on-Trent.—Electricity Department. Plant and materials for a water-pumping scheme, including pumps, cast-iron piping, valves, chlorinating plant, &c. (April 17th.)

South Africa.—CAPE TOWN.—May 22nd. South African Railways and Harbours. Two electric goods lifts.*

Uruguay.—MONTEVIDEO.—June 10th. State Electricity Works. Six aerial transformer sub-stations.*

Wigan.—May 25th. Board of Guardians. One electrically-driven vertical pumping plant, heating and domestic hot-water supply apparatus, alterations to buildings, &c. (April 24th.)

Wolverhampton. — May 7th. Education Committee. Electric light and power installation, engineering block, New Technical College. Mr. T. A. Warren, Director of Education, North Street. (Returnable deposit of £3 3s.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdare.—Electricity Committee. Recommended:—
Overhead and underground mains, public lighting, sub-station and equipment (£12,253).—Pirelli-General Cable Works, Ltd.

Ayrshire.—Irvine Town Council. Accepted:—
Electric lighting of the Town House.—Campbell Banks.

Basingstoke.—Electricity Committee. Accepted:—
Switchboard panel (£208).—Park Royal Engineering Co., Ltd.

Brighton.—Electricity Committee. Accepted:—
Five-ton electric goods lift (£488).—Marryatt & Scott, Ltd.
400-kW turbo-generator, with pumps and accessories (£4,429).—W. H. Allen, Sons & Co., Ltd.

Edinburgh.—Corporation. Accepted:—
14 feeder panels.—Park Royal Engineering Co., Ltd.

Glasgow.—The Work and Stores Sub-Committee of the Corporation Tramways Committee recommends acceptance of the lowest tender—that of the United States Steel Products Co.—for the supply of special track material. The difference between the successful tender and the lowest British offer is stated to be about £300.

Irish Free State.—Contracts placed by the Controller of Stores, Department of Posts and Telegraphs, during March, 1925:—
Lead-covered cable.—F. Routledge; Callender's Cable & Construction Co., Ltd.; W. F. Dennis & Co.; and J. McMillan & Co.
Telephone parts.—Le Carbone; British L. M. Ericsson Mfg. Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.
Telephone terminal blocks.—Thomas de la Rue & Co., Ltd.—*Irish Electrician.*

India.—Calcutta Electric Supply Corporation, Ltd. Accepted:—
Water-tube boilers, including buildings and complete equipment.—Vickers-Spearing Boiler Co., Ltd.

Kent.—County Council. Accepted:—
Main switchboard and cables for Chartham Mental Hospital.—Park Royal Engineering Co., Ltd.

London.—POPLAR.—Electricity Committee. Recommended: Extension of generating station:—
Excavation of trenches, foundations, concrete reinforcing bars, &c. (£3,923); structural steelwork (£18,146).—Mitchell Conveyor & Transporter Co.

ST. MARYLEBONE.—Electric Supply Committee. Recommended:—
Partial replacement of cooling towers No. 1 and 2 and provision of additional louvres to No. 3 (£9,629).—Clyne Engineering Co., Ltd.
E.h.p. switchgear in connection with the supply to the N.E.R. (£1,909).—Ferguson, Pailin, Ltd.
Oil purifier (£271).—De Laval Chadburn Co., Ltd.
Dielectrimeter (£35).—Empson Centrifugals, Ltd.

Luddenden Foot.—Urban District Council. Accepted:—
Electrician's work in connection with the erection of houses at Warley Wood.—Fielding & Cotton.

Portsmouth.—The Town Council, at its meeting last week, confirmed the Electricity Committee's recommendation to accept the Fraser & Chalmers Engineering Works' tender for one 8,000-kW turbine and condenser, at £29,210.

Tramways Committee. Accepted:—
Steel tires.—Steel, Peech & Tozer.

Preston.—Electricity Committee. Recommended:—
Supply and laying of the Preston portion of the Preston to Blackburn main (£27,343).—British Insulated & Helsby Cables, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Joint boxes (£456).—Lucy & Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended:—
Switchgear required in connection with further developments of the 4,000-volt system (£1,760).—A. Reyrolle & Co., Ltd.
Six cast-iron pillar boxes (£130).—Premier Foundry Co.
2,500 imperial gallons transformer oil (£400).—South African General Electric Co.
1,500 gallons switch oil (£163).—Davis & Soper, Ltd.
25 miles insulated wire (£436).—C. E. Scott.
1,000 4-wire galvanised channel cross arms (£251).—Davis & Soper, Ltd.

Tynemouth.—Electricity Committee. Accepted:—
Supplies of cable (£903).—Hackbridge Cable Co., Ltd.; (£938).—Johnson and Phillips, Ltd.; (£192).—Macintosh Cable Co., Ltd.

Forthcoming Events.

London Association of Foremen Engineers.—Saturday, May 2nd. At the Cannon Street Hotel. At 6.30 p.m. Anniversary Festival.

Institution of Civil Engineers.—Tuesday, May 5th. At the Institution, Great George Street, S.W. At 6 p.m. James Forrest Lecture on "Heavy Oil Engines: Some Outstanding Questions Relating to Large Engines of the Self-ignition Type," by Capt. H. Riall Sankey.

Wednesday, May 6th. At 6 p.m. Joint meeting with the other bodies which are co-operating in the work of the Special Committee on Tabulating the Results of Heat-engine Trials. Paper on "A Standard Code for Tabulating the Results of a Heavy-oil Engine Trial," by Mr. J. Carnaghan.

Roentgen Society.—Tuesday, May 5th. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary Scientific Meeting.

Institute of Metals.—Wednesday, May 6th. At the Institution of Mechanical Engineers. At 8 p.m. Lecture on "The Motion of Electricity in Metals," by Dr. H. A. Lorentz.

Iron and Steel Institute.—Thursday and Friday, May 7th and 8th. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting.

Thursday evening, May 7th. At the Hotel Cecil. Annual dinner.

Institution of Electrical Engineers.—Thursday, May 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Annual general meeting.

(Wireless Section).—Wednesday, May 6th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Report on "Measurements made on Signal Strength at Great Distances during 1922 and 1923 by an Expedition sent to Australia," by Capt. H. J. Round, Messrs. T. L. Eckersley, K. Tremellen, and F. C. Lunnon, of the Research Department, Marconi's Wireless Telegraph Co., Ltd.

(Western Centre).—Monday, May 4th. At the Merchant Venturers' Technical College, Bristol. At 6 p.m. Paper on "The Design of Electrical Plant Control Gear," by Mr. H. W. Clothier, to be read by Mr. L. E. Mold.

Edinburgh Electrical Society.—Friday, May 8th. At the Philosophical Institute, 4, Queen Street. At 8 p.m. Business meeting and visit to Edinburgh B.B.C. Relay Station.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

Insulated box spanners.
Machinery for cleaning cotton yarn by electricity.
BELL radiators.
Pivots for electrical instruments.
A Violet Ray apparatus known as Dr. Arnone's patent.

Notes.

The Solar Eclipse of January 24th. — The Illuminating Engineering Society, U.S.A., organised a number of photometric expeditions to take observations during the solar eclipse, and has embodied the results in an advance report presented at a meeting of the New York Section on April 9th. The report gives an interesting account of the phenomenon, with numerous reproductions from photographs, curves, &c. The minimum illumination on a horizontal plane at the moment of totality was 0.25 ft.-candle.

X-Ray Examination of Coal. — In a lecture on "The Scientific Control of Coal-washing with the Application of X-rays to the Examination of Coal" (abstracted in *The Iron and Coal Trades Review*), Mr. W. McLaren, of Glasgow, explained that the use of X-rays had recently for the first time been introduced into coal examination for industrial purposes. By the use of X-rays the determination on an absolute basis of the ash inherent in the coal substance proper was made possible with an ease and precision previously unattainable. This ash could not be washed out by any process whatever and it became necessary to introduce a new term, commercial ash, being the sum of the fixed ash and the proportion of the free ash which might be left in the product, which the X-ray examination made it possible to determine.

The British Science Guild.—At the annual meeting of the British Science Guild, on April 21st, Lord Askwith, K.C., president of the Guild, occupied the chair, and pointed out that one of the chief functions of the Guild was to further co-ordination in both public and private affairs. Six standing committees had been formed, of which four were already working. Sir William Bragg, F.R.S., delivered an address, in the course of which he emphasised the importance of explaining scientific facts to the public, whose lives largely depended on the results of scientific work. The difficulty was to find competent exponents of science. Major the Hon. H. Fletcher Moulton pointed out that in order to convince business men of the efficacy of scientific methods they must be shown that the methods recommended would be of commercial advantage to them. There was a gap between the laboratory worker and the manufacturer which ought to be filled up.

Energy for the "Underground."—Some interesting items regarding the generating costs at Chelsea, which were issued with the weekly traffic notice to the staff of the "Underground," are given in the *Railway Gazette*. The consumption of coal at Lots Road has now reached more than 750 tons per day and the load is equivalent to 90,000 h.p. at the busiest hour. The heavy load period, which conforms to the rush-hour traffic, lasts for about four hours daily. During the middle of the day the load falls to little more than one-half. At peak-load, 56 boilers are under steam, about 34 in the middle of the day, whilst at night two are sufficient to take the load. Nearly 50 tons of coal are burned each day in "banking" boilers in readiness for the heavy-load period.

It is pointed out that the load on the power-house is to an appreciable extent under the control of the users of energy on the railways, and economy in its consumption is urged.

Public Lighting Conference.—In connection with the conference at Leeds arranged by the Institution of Public Lighting Engineers for September next, referred to in our columns of April 10th, the Minister of Health, as a result of application by the Institution secretary, will be prepared to consider applications from local authorities whose accounts are subjected to Government audit, for sanction to the payment of the expenses of the attendance at the conference of not more than two delegates, one of whom should be the engineer or superintendent for public lighting in the district.

Electric Mine Locomotives.—YORKSHIRE TESTS.—On April 29th an important series of tests with electric locomotives designed for the haulage of corves in coal mines was to be made at Brodsworth, near Doncaster. Mr. Charles Markham some time ago offered a prize of £1,000, the idea being to devise a system to displace the use of pit ponies. Five firms have submitted models in accordance with the terms of the competition, which state that the height must not exceed 3 ft. 6 in., that the frame of the engine must have a certain clearance above the track, that it must be gasproof, and so far as possible dust-proof, and that its mechanism must be such that there is no possibility of gas being ignited by it. The tests were to be made under the supervision of the Ministry of Mines.

Information Bureaux and Specialist Libraries.—A highly-successful conference held at Hoddesdon in September, 1924, on "Special Libraries and Information Bureaux" has resulted in financial support being obtained from the Carnegie United Kingdom Trustees for a period of two years, in order to give the new movement an opportunity of becoming self-supporting. Mr. G. W. Keeling, of 71, Temple Row, Birmingham, has been appointed organising secretary to the Committee which was formed during the conference to ensure the continued co-operation of the interests there represented. Arrangements are being made for the holding of a second week-end conference at the end of September of this year, and for the preparation of a Directory of Special Libraries and Information Bureaux for the United Kingdom.

Educational.—ILLUMINATING ENGINEERING.—The course of twelve lectures on Illuminating Engineering now being delivered at the Polytechnic (Regent Street), commenced on Monday, April 20th, when Mr. Leon Gaster made a few remarks introducing the first lecturer, Mr. J. W. T. Walsh, of the National Physical Laboratory. Mr. Walsh, who dealt with "The Nature of Light and its Measurement," gave an excellent review of modern photometric methods and was judicious in his selections from the very wide field covered by his title. The second lecture, by Dr. James Kerr, on April 22nd, was devoted to a consideration of the eye. Dr. Kerr explained the processes of adaptation and accommodation, and showed, by homely illustrations, how effects of glare and severe contrast add to the strain of vision. The final portion of the address contained some information on the effect of ultra-violet light on health and disease, several curious facts—such as the relation between exposure to light of milk and its nutritive properties—being mentioned. Subsequent lectures will deal with electric lamps and lighting problems, in schools, factories, shops, streets, railways, &c.

The London Electrical Engineers.—NIGHT OPERATIONS.—During the last few nights the 27th A.A. Battalion R.E. (T.A.), (London Electrical Engineers), has participated in night operations over London with aircraft, searchlights, and sound locators, between 9.15 and 10.15 p.m. The Battalion manned four temporary searchlight stations at Battalion Headquarters, the Royal School of Mines, the Windmill on Wimbledon Common, and at Brook Green, Hammersmith. Aircraft flew over the "defence" line formed and were located at certain stations by sound locators and illuminated by all searchlight stations. The plant employed consisted of 50-h.p. vertical high-speed petrol engines, direct coupled to generators, on Dennis-Stevens petrol-electric lorries, with 4-foot and 3-foot searchlight projectors. It is hoped that many interested in a patriotic, useful, and most interesting recreation will be moved to join the ranks of those engaged on this work.

A Technical Esperanto Conference.—An international conference in favour of adopting the universal language Esperanto in connection with pure and applied science, is to be held in Paris from May 14th to 16th next, under the auspices of a number of technical societies, including the French Association for the Advancement of Science and the French Société d'Encouragement pour l'Industrie Nationale.

Subsidy for Power Alcohol Beets.—An effort is being made by the British Power Alcohol Association, 3, Old Queen Street, Westminster, to obtain for beets grown for power alcohol the same subsidy as has been recently accorded to beets grown for sugar, under the British Sugar (Subsidy) Act, 1924. The Association advocates the establishment of small distilleries, within short distances of the areas of supply, spread all over the country for the purpose of producing power alcohol from beet. The distilleries would be capable of dealing with any quantities up to 250 tons of beet per day, which could be delivered by the farmers themselves.

There is no intention of selling power alcohol as a substitute for petrol, but, as is the case with benzol, of mixing, after a simple and inexpensive treatment, with petrol in any quantities up to 50 per cent.

It is considered that in a few years, if the industry is assisted in the early stages, Great Britain should be able to supply from 30 to 40 per cent. of her present motor fuel requirements.

Production of Small Voltages and Currents at Radio Frequencies.—In a paper recently read before the Wireless Section of the Institution of Electrical Engineers, Mr. D. W. Dye, B.Sc., of the National Physical Laboratory, outlined a method whereby small known voltages and currents may be produced at radio frequencies for calibration purposes by means of a current transformer, across the secondary of which is a suitable resistance of known value. A thermo-junction or other device serves to measure or to set the primary current. Pressures from a few microvolts to a few tenths of a volt may be conveniently produced, and the nature and extent of the errors of the method are discussed, the precautions necessary to reduce these to a negligible amount being indicated. Various uses of the method are touched upon and its limitations are pointed out, while an appendix gives a simple analytical treatment of the iron losses in the core of a current transformer at radio frequencies, in so far as they affect the ratio of the transformer. The phase displacement of the currents is, however, not discussed.

"Ferrocrete" Under Test.—A report by Dr. Oscar Faber, O.B.E., D.Sc., M.Inst.C.E., on tests carried out on "Ferrocrete," the new rapid hardening Portland cement, is issued by the Cement Marketing Co., Ltd. The tests revealed that concrete cubes made of the new cement have crushing strengths 3½ times as great as ordinary cement at four days, 3¼ times as great at four weeks, and 2½ times as great at three months. Reinforced concrete beams made with the new cement will stand a breaking load approximately three times as heavy at four days, twice as heavy at four weeks, and 1¼ times as heavy at three months as beams made with ordinary cement. There is also indication that these last-mentioned ratios (in each case) are maintained at greater ages. Dr. Faber, in concluding his report, says that not only will it have special importance in cases where an early strength is required, but the greatly increased strength of "ferrocrete," even at later dates, should justify substantially greater working stresses with this improved material, and so make it specially useful and economical for reinforced concrete columns, beams, and structures generally.

Electrically Hardening Tubes.—A process used by an American concern for hardening thin-walled tubes consists of setting up the tubes vertically, each being gripped at each end by copper contacts, so that it forms a resistance element and becomes heated when the current is turned on. No pyrometer is required, the elongation sufficing to indicate the right temperature. As soon as the latter has been reached, the jaws open and the tube drops into an oil-bath below. The temperature required is lower than it would be in any hardening furnace; the critical temperature, moreover, is easily noted by observing the magnified reading of a pointer which shows the increase in the length of the tube. Such lengthening ceases at the moment the critical temperature is reached. Advantages of the process are the short time required for heating, being only 20 to 30 seconds, while no scale is formed.

Energy Utilisation at Times of Low Load.—An electrical conference, organised by the Compagnie de Gas de Lyon, under the auspices of the Syndicat des Producteurs et Distributeurs d'Electricité du Sud Est, has been held at Lyons in connection with the big fair in that city, the proceedings extending over two days. The object of the conference, which was the third of its kind since 1923, and which was attended by technical men from the principal industrial centres of France, was to discuss under its various aspects the problem of the better utilisation of electrical energy during the day-time, when the consumption is less owing to the closing of the works (11 a.m. to 1 p.m.) or the temporary suspension of urban activity during certain hours of the night. Papers were presented on the development of the use of apparatus which use energy during the hours of low demand, as well as on electric traction by accumulators as represented by the storage battery omnibuses which serve the main streets of Lyons. The question of heating by accumulation was also discussed, and subsequently a visit was paid to the model installation of central heating by means of electric boilers erected on the premises of the Lyons Gas Company. M. d'Aubanton, general manager of the latter, prior to the visit, gave a description of the installation, and pointed out the services which could be expected to be rendered by a system of central heating.

Steel-hardening Temperatures.—It is almost common knowledge that the hardening of steel does not depend upon temperature alone, but is also governed by the rate of heating. This last factor is too often ignored, with the result that although full file hardness is obtained, yet really satisfactory "life" is not secured in the articles treated. The Automatic & Electric Furnaces, Ltd., state that temperature curves which they have of a steel when heated at two different rates, show that when heated slowly the steel reaches its critical point at a temperature of 730 deg. C., but if heated more quickly, but not excessively quickly, the critical temperature is 760 deg. C. This interdependence of time and temperature is not sufficiently appreciated by hardeners, but it is extremely important, as an overheat of 30 degrees such as must so easily occur in practice, besides leading to a coarsening of the grain with a consequent shorter life, also leads to greater liability to crack, and to distort in quenching.

The Royal Naval Division Memorial.—On Saturday last the fountain erected on the Horse Guards Parade in memory of the Royal Naval Division was unveiled by Major-General Sir Archibald Paris with appropriate ceremonial. An address was delivered by Mr. Winston Churchill, M.P., who dwelt on the famous lines of Rupert Brooke, a member of the Division, inscribed upon one of the panels: "If I should die, think only this of me: That there's some corner of a foreign field that is for ever England," and the enormous sacrifice made by those to whom the memorial was erected. From their selfless devotion good would come to their countrymen; the freedom not only of inidividuals, but of States, had been established on a sure foundation, and their sacrifice had not been made in vain.

Late Legal. — SOUTHPORT CORPORATION *v.* BIRKDALE DISTRICT ELECTRIC SUPPLY CO., LTD.—The Court of Appeal decided on April 28th that the contract in question in this case (see p. 720) was legal and not detrimental to the company. The Corporation's appeal was therefore allowed with costs. The judgment of the Master of the Rolls will be reported in our next issue.

Large Hydraulic Turbines.—According to *Power*, the turbine wheels which are being used in the five new installations at Chaucy-Pougny on the River Rhone, near Geneva, were supplied by the Skoda Steel Works, Pilsen, Czecho-Slovakia, and are of record size. One of the wheels has an outside diameter of 17 ft 7 in., and weighs 24 tons. It is made of two parts and has 18 vanes, and the material in the crown plate and band is of cast-steel of about 65,000 lb. tensile strength and 15 per cent. elongation. The vanes are of ¾ in. rolled steel of a tensile strength of 75,000 lb., and an elongation of 20 per cent. They are pressed to shape in dies. Another is 18 ft. 2 in. in diameter, weighs 28½ tons, and has 12 vanes 1 in. thick.

There is 14,500 cu. ft. per sec. of water, with an average head of 25 ft., available during from 90 to 150 days of the year. The average flow is two-thirds of this quantity, and the low water measures about one-fifth. The net head normally varies from 24.5 ft. to 26.6 ft., but at high water the head is reduced to 13.2 ft.

With a net head of 24.5 ft. and operating at 83 r.p.m., each turbine develops, normally, 7,600 h.p. At best gate opening an efficiency of over 90 per cent. is expected.

Australian League Visit to G.E.C. Works. — The members of the Young Australian League at present touring Great Britain were the guests on Saturday, April 18th, of the General Electric Company, Limited, at its works at Witton. The general impression of the boys and their officers when they left the works was that they had been privileged to see one of the largest groups of electrical works in the world. They were keenly interested in all they saw, but not unnaturally they evinced most pleasure in the manufacture of turbo-alternators because in this department of the works they gathered that recently three machines with a total output of some 50,000 h.p. had been completed for the municipalities of Sydney, Adelaide and Brisbane.

The arrangements for the tour of the works were excellent in every way. When it was completed an adjournment was made to the Magnet Club, where an excellent lunch was prepared. Mr. Hugo Hirst (chairman of the G.E.C.) presided, and was supported by the Lord Mayor of Birmingham (Alderman Percival Bower), and many other distinguished gentlemen.

Battery-charging Solutions.—As a result of the many wonderful solutions by means of which it is claimed that accumulators can be re-charged instantly or in a short time, as compared with the usual process, that have lately made their appearance, the U.S. Bureau of Standards has deemed it advisable to issue a notice drawing attention to the fact that changing a solution in a battery does not charge it instantly. Tests have shown that batteries containing these solutions, contrary to the claims made for them, behave in accordance with well-established laws of electrochemistry. Analysis revealed that the solutions contain from 38 to 42 per cent. of sulphuric acid, which is about the amount in the ordinary electrolyte of a motor vehicle battery when charged. In some of them were found also significant amounts of sodium, or magnesium, as well as colouring matter. The sodium may have been added as soda, lye, or Glauber salts; the magnesium as Epsom salts. It is pointed out that the use of sodium sulphate (Glauber salts) in batteries was suggested more than 35 years ago, but the fact that such material is without beneficial effect has been confirmed by the U.S. Bureau's recent experiments, which show the rate of sulphation of plates to be unaffected by even 4 to 5 per cent. of Epsom or Glauber salts.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the meeting of the informal section on April 20th, Mr. W. E. Warrilow was in the chair when Mr. M. Hart opened a discussion on "Latter-day Wireless." He mainly devoted his criticism to what he termed the appalling technical inaccuracies in many of the articles in the lay Press and even in journals published exclusively for radio matters. There were about 30 radio periodicals appearing every month, and each felt it was required to devise two new receiving circuits per issue, with the result that old circuits reappeared under new names, and there was no standard or finality. A lively discussion by 13 speakers followed, which in the main supported Mr. Hart's attack. Mr. P. W. Willans said a great deal of apparatus was advertised in a way that deliberately misled, which was far more important than inaccurate terminology. Mr. J. Coxon pointed out that Mr. Hart was tilting at papers that pandered to the tastes of amateurs of all kinds and ages, but there was no fault to find with the true technical journals. Mr. W. Day thought the I.E.E. should compile and maintain a list of accepted standard terms in which the meaning of technical expressions should be accessible to all.

MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.—The annual general meeting of the Centre was held on April 20th at the University, Liverpool. The following were elected to complete the committee for next session:—Chairman: Mr. A. E. Malpas. Vice-chairmen: Mr. P. J. Robinson and Assoc. Professor F. J. Teago, D.Sc. Hon. secretary and treasurer: Mr. O. C. Waygood. Members of committee: Messrs. L. Breach, T. Cornfoot, H. Dickinson, and P. Priestly. After the general meeting, Mr. Perry read Major E. I. David's paper on "Electricity in Mines," and a very interesting discussion followed.

SPECIMENS OF MICA.—A collection of 90 specimens of mica will be on view in the library of the Institution of Electrical Engineers for the next few months. A table is also available showing the classification of the specimens, and giving their composition, characteristics, descriptions, and trade names.

I.E.E. WAR MEMORIAL BOOK.—The War Memorial Book, containing the biographical notices of the 162 members of the Institution who fell in the war of 1914-1919, has just been published, and copies have been presented on behalf of the subscribers to the War Memorial Fund to the nearest relative of each fallen member. It is a large post folio volume (15¼ in. by 10 in.), bound in special buckram, and contains 345 pages of letterpressset in 12-pt. old style type and 159 portraits. The biographical notices are preceded by an historical introduction entitled "The Origin and Causes of the Great War, 1914-1919," written by the editor of the book, Lieut.-Colonel W. A. J. O'Meara, C.M.G., R.E. Additional copies of the book have been printed, which will be on sale to members and the public at the price of £2 2s. each, and the proceeds will go to the War Memorial Fund. A specimen copy can be seen in the library of the Institution.

Junior Institution of Engineers. — On April 24th, Mr. H. E. Cowley delivered a lecturette on "The Manufacture of Gramophone Records," describing the preparation of the wax blanks that eventually became master records, and the recording machines. After the master record had been produced, he said, a matrix was obtained from it by an electrolytic process in which copper was deposited on the surface, the result being a metallic negative. The next step was to produce a metallic positive, or "mother" matrix, from the negative by a similar process. A record could not be pressed from the positive, and therefore it was necessary to produce what were known as "stampers." These were made from the mother matrix by depositing first of all nickel and then backing up with copper. About 50 stampers could be obtained from one mother matrix. The actual pressing of records was done in a hydraulic press, the platens of which were jacketed so that steam and cold water could be passed through for softening and then hardening the record.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The *Board of Trade Journal* says that Mr. N. F. ELMSLIE, Trade Commissioner in New Zealand, is in attendance at the Department of Overseas Trade, 35, Old Queen Street, S.W.1, for about three weeks from April 27th. British manufacturers and traders can interview Mr. Elmslie by appointment. They should quote the reference 5,739 T.G.

Mr. E. P. BENNETT, of Messrs. Cargills, Ltd., Balfour House, London, E.C., will be leaving on a further visit to Australia and New Zealand in July or August next, and he wishes to hear from manufacturers desiring to make agency or other business arrangements.

There were 115 applicants for the post of engineer-manager to the Inverness Town Council's electricity undertaking, and Mr. BLAIR SMITH, the electrical engineer, was recently authorised to draw up a leet of seven.

In connection with Walsall Unionist Club, a dinner was held at Walsall on Thursday last week to celebrate the return of Mr. W. PRESTON, M.P., at the Parliamentary elections of October, 1924, and February, 1925. Sir Richard Cooper, on behalf of the members of the club, presented Mr. Preston with a gold cigarette box and gold pencil, and Mrs. Preston with a dressing table set.

Mr. W. S. FLIGHT, late of the Electrical Research Association, and formerly chief of the insulation section of the research laboratories of the Metropolitan-Vickers Electrical Co., Ltd., has joined the De Laval Chadburn Co. in an executive capacity; Mr. BERTRAM MAY, late of Messrs. Harris & Dixon, Ltd., has joined the company as commercial manager; and Mr. N. W. PRANGNELL is arranging an extensive tour in order to visit the various De Laval companies, representatives, and agents throughout the world.

Alderman SAMUEL FLINT, J.P., for many years chairman of the Leicester Electricity Committee, and previously of the Tramways and Electricity Committee, is resigning his seat on the Leicester City Council after nearly 35 years' service. For some years past Mr. Flint has been gradually divesting himself of municipal responsibilities, and in 1920 declined the mayoralty of the city on account of ill-health. He has been residing at Eastbourne for some time.

Mr. W. T. RICHARDS, of Sheffield, has been appointed traffic superintendent of the Rotherham Corporation tramways in succession to Mr. W. G. Marks, who has become tramway manager at Chesterfield.

Mr. PERCIVAL FRANCIS CRINKS, the London sales manager of the Metropolitan-Vickers Electrical Co., Ltd., has accepted the position of managing director of Metro-Vick Supplies, Ltd. Mr. Crinks studied under Prof. Chattock, of Bristol University, and afterwards became a pupil of Mr. H. Faraday-Proctor. His connection with the Metropolitan-Vickers Electrical Co. began in the year 1910. Members of the Engineers' Club, London, will be familiar with the work he has done there as a member of the Executive Committee. He is now vice-chairman of the General Committee of the club.

Obituary.—SIR DAVID SALOMONS.—At the funeral of Sir David Salomons, which took place at Tunbridge Wells on Friday, April 24th, the Institution of Electrical Engineers was represented by Mr. W. M. Mordey, one of its past-presidents. Mr. J. B. Braithwaite, of the City of London Electric Lighting Co., was also among those present. The interment took place at the private chapel ground at Lower Green, Tunbridge Wells.

The many friends of Mr. A. L. C. FELL, C.B.E., will, we are sure, desire to associate themselves with us in an expression of sympathy with him on the loss of his wife. Mrs. Fell passed away suddenly at Ryestead Common, Chiddingfold, on April 24th.

MR. J. KERR.—The *Tramway and Railway World* records the death, at the age of 73 years, of Mr. John Kerr, at one time chairman of Dick, Kerr & Co., Ltd., and for many years a director of the former Edinburgh and District Tramways Co.

Wills.—The late Mr. J. B. HAMILTON, of Leeds, left £29,459 net and £31,182 gross personalty.

Sir T. E. THORPE, C.B., F.R.S., D.Sc., LL.D., a former president of the British Association and vice-president of the Royal Society, left £18,170 gross and £15,068 net personalty.

The late Mr. W. L. MADGEN left £14,857.

New Companies Registered.

Kirby (Wimbledon), Ltd. (205,358). — Private company. Registered April 18th. Capital, £2,000 in £1 shares (1,000 "A" preference, 250 "B" preference, and 750 ordinary). Objects: To adopt an agreement with T. W. M. Kirby and to carry on the business of wireless dealers and manufacturers, electrical engineers, &c. The first directors are:—T. W. M. Kirby, 72, Merton Road, Wimbledon, S.W., engineer; P. T. A. Driver, The Croft, East Sheen, S.W.14, engineer; O. B. Thompson, Le Piguetier, Vicarage Road, East Sheen, S.W.14, engineer. Qualification, one ordinary share. Solicitors: Jaques & Co., 8, Ely Place, E.C.1. Registered Office, 72, Merton Road, Wimbledon, S.W.

Nadin and Dell Electric, Ltd. (205,345).—Private company. Registered April 18th. Capital, £3,000 in 1,500 ordinary and 1,500 preference shares of £1 each. Objects: To acquire the business carried on by B. Nadin and P. J. Dell at 64/66, Sankey Street, and 29, Bridge Street, Warrington, as the "Economic Electric Co.," and to carry on the business of electrical engineers, motor engine makers and dealers in wireless receiving sets and wireless apparatus, &c. The permanent directors are:—B. Nadin, "Woodly," Thelwall New Road, Latchford, near Warrington; P. J. Dell, "Delmayne," West Avenue, Stockton Heath, near Warrington. Qualification, 300 shares. Remuneration as fixed by the company. Registered office: 29, Bridge Street, Warrington, Lancs.

Cooke & Stevenson, Ltd. (205,353). — Private company. Registered April 18th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with W. A. C. Cooke and J. H. Stevenson, and to carry on business as wireless apparatus manufacturers, electroplaters, electrical apparatus manufacturers, electrical engineers and designers, &c. The directors are:—W. A. C. Cooke, 36, Stannington View Road, Crookes, Sheffield, electrical engineer; J. H. Stevenson, 15, Brighton Terrace Road, Sheffield, electrical engineer. Qualification, 250 shares. Remuneration as fixed by the company. Solicitors: Chambers & Sons, 26, Bank Street, Sheffield.

Abies Battery Co., Ltd. (205,354). — Private company. Registered April 20th. Capital, £2,000 in £1 shares. Objects: To acquire the business of manufacturing and dealing in electric batteries and their parts and other articles used in connection with the supply, distribution, and consumption of electricity; manufacturing and dealing in wireless apparatus and electrical and general engineering now carried on by C. B. Elliott at premises at rear of 125-131, Anerley Road, Anerley, Surrey, as the Associated Battery Co. The permanent directors are:—F. R. Hill, Beaconsfield, Grange Road, Sutton, Surrey, merchant; A. H. Thorne, 26, Bromley Grove, Shortlands, Kent, commercial traveller. Solicitors: Bryson and Wells, 1-2, Queen Street, Cheapside, E.C. Registered office: Bassishaw House, 76a, Basinghall Street, E.C.

Spa Radio Co., Ltd. (205,385).—Private company. Registered April 20th. Capital, £1,000 in £1 shares. Objects: To carry on the business of engineers, founders, smiths and machinists, manufacturers, assemblers and installers of and dealers in wireless receiving and broadcasting sets, &c. The first directors are:—G. A. Glisson, 10, Milk Street, Bath; T. P. Wigmore, 103, Locksbrook Road, Bath; S. G. Cooke, 1, Fairfield Villas, Henrietta Park, Bath; W. Rodd, 26, Park Row, Weston, Bath; H. E. Lever, 3, Park Street, Bath. Qualification, 100 shares. Secretary: H. E. Lever. Solicitor: W. A. Sparrow, 1-2, Chapel Row, Queen Square, Bath. Registered office: 107a, Locksbrook Road, Weston, Bath.

Read & Morris, Ltd. (205,483).—Private company. Registered April 24th. Capital, £2,000 in 1,200 founders' shares of 1s. and 1,880 ordinary shares of £1 each. Objects: To acquire the business of wireless engineers carried on as "Read & Morris" at 31, East Castle Street, Oxford Street, W. The subscribers (each with one £1 share) are:—A. E. Morris, 31, East Castle Street, W.1, radio engineer; W. E. H. Humphreys, Bond Street House, Bond Street, W.1, radio engineer. The permanent directors are:—F. O. Read and W. E. H. Humphreys. Qualification, £10 shares or stock. Remuneration as fixed by the company. Secretary: W. E. H. Humphreys.

Lettrophones (1925), Ltd. (205,475).—Private company. Registered April 24th. Capital, £1,500 in £1 shares. Objects: To adopt an agreement with Lettrophones, Ltd. (in liquidation) and E. C. Elsmore, the liquidator thereof, to acquire patents Nos. 8,195, of 1912, and 8,342, of 1912, and to carry on the business of manufacturers of and dealers in lettrophones, gramophones, phonographs, and all other apparatus or instruments for the recording and reproduction of speech or other sounds, and the production of animated photographs; electricians, electrical, mechanical, hydraulic, metallurgical and chemical engineers, &c. The first directors are:—C. Marshall, 2, Ranelagh Avenue, Hurlingham, S.W.6; E. C. Elsmore, 44, Meadway, N.W.11. Qualification, 100 shares. Secretary: E. C. Elsmore. Solicitors: Wynne-Baxter and Keeble, 9, Laurence Pountney Hill, E.C.4. Registered office: 9, Laurence Pountney Hill, E.C.4.

Benbat Radio, Ltd. (205,407).—Private company. Registered April 22nd. Capital, £2,000 in £1 shares. Objects:—To adopt an agreement with J. F. Bennett, and to carry on the business of inductance coil manufacturers and dealers, electroplaters, electrical and wireless apparatus manufacturers, &c. The directors are:—J. F. Bennett, Gordon Cross House, Dronfield, engineer; J. Pownall, 161, Don Road, Sheffield, steam crane driver; H. Allen, 46, Cyclops Street, Sheffield, engineer. Qualification, 50 shares. Remuneration as fixed by the company. Solicitors: S. B. Attenborough, 26, Bank Street, Sheffield.

Radio Service Co. (Birmingham), Ltd. (205,396).—Private company. Registered April 21st. Capital, £300 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in wireless apparatus, &c. The subscribers (each with one share) are:—G. Myatt, 44, Lyndon Road, Sutton Coldfield, accountant and auditor; F. H. Lee, 12, Morden Road, Stechford, automobile engineer. G. Myatt is to be one of the first directors and shall be permanent. Qualification, 1 share. Solicitor: H. Roberts, 28, High Street, Birmingham. Registered office: 16, Warwick Chambers, Corporation Street, Birmingham.

British Instrument Co., Ltd. (205,389).—Private company. Registered April 21st. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of instruments and other goods (not fully described), &c. The subscribers (each with one share) are:—H. T. Blizard, 16, Bedford Row, W.C.1, solicitor's managing clerk; H. P. Simpson, 16, Bedford Row, W.C.1, solicitor's clerk. The subscribers are to appoint the first director, who shall be permanent subject to holding 20 shares. No qualification required for directors. Remuneration, £50 each per annum (chairman, £100). Secretary: P. J. Byrne, London Aerodrome, Hendon, N.W.9. Solicitors: Winter, Tucker, Lake and Wood, 16, Bedford Row, W.C.1. Registered office: 7-8, Norfolk Street, Strand, W.C.2.

Willet & Robinson, Ltd. (205,401).—Private company. Registered April 21st. Capital, £7,000 in £1 shares (3,000 7 per cent. "A" cumulative preference, 1,000 8 per cent. "B" non-cumulative preference, and 3,000 ordinary). Objects:—To acquire the business carried on at Maidstone as Willet and Robinson, and to carry on the business of electrical and mechanical engineers, copper and tin smiths, brass founders and finishers, japanners, enamellers, stampers and finishers, manufacturers of and dealers in hardware, &c. The first directors are:—C. I. Betts, Royal Star Hotel, Maidstone, wholesale manufacturing confectioner; J. G. Clarke, "Yoxford," Cornwallis Road, Maidstone, builder; H. C. Clark, Hayle Place, Maidstone, manufacturer; L. M. Freeman, 12, Streatham Hill, S.W., manufacturer and importer (all life directors). Qualification, £100. Solicitor: F. Miskin, 44, Earl Street, Maidstone. Registered office: The Works, Market Street, Maidstone, Kent.

Official Returns of Electrical Companies.

Telegraph Construction & Maintenance Co., Ltd. (1,147C).—Return dated March 19th, 1925. Capital, £896,400 in 74,700 shares of £12 each. All shares taken up. £448,200 paid. £448,200 considered as paid. Mortgages and charges, nil.

Reed, Evans & Co., Ltd. (72,015) (formerly the Railway Finance & Construction Co., Ltd.).—Return dated December 31st, 1924. Capital, £100,000 in £1 shares. 92,292 shares taken up. £1 per share called up on 657 and 4s. per share on 29,595 shares. £6,576 paid. £85,716 considered as paid, being £1 per share on 62,040 and 16s. per share on 29,595 shares. Mortgages and charges, nil.

Wilson, Hartnell & Co., Ltd.—P. M. Wilson, of 17, East Parade, Leeds, ceased to act as receiver or manager on April 6th, 1925.

Bower Electric, Ltd. (Amended Notice).—F. E. Kewley, of 1, Highbury Grange, Highbury, N.5, appointed receiver and manager on March 26th, 1925, under powers contained in debentures dated December 4th, 1924. (A solicitor's letter suggests that an earlier appointment of Mr. Kewley in same capacity was *ultra vires* and premature.)

Electrical Contracts and Maintenance Co., Ltd. (Old Co.).—C. H. Barham, of College Hill Chambers, E.C.4, ceased to act as receiver or manager on April 6th, 1925.

Bowers & Barr, Ltd. — Mortgage on freehold messuage and appurtenances at Hall Plain, Great Yarmouth, with fixtures, &c., dated April 8th, 1925, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

British Radio Valve Service, Ltd.—Debenture dated March 30th, 1925, to secure £500 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: A. J. Wilson & Co., Ltd., 154, Clerkenwell Road, E.C.1.

Orford Electric Light and Power Co., Ltd. — Issue on April 1st, 1925, of £300 debentures, part of a series already registered.

Northallerton Electric Light and Power Co., Ltd. (259,301).—Return dated March 11th, 1925. Capital, £6,500 in 2,900 preference shares of £1 each and 12,000 ordinary shares of 6s. each. 1,161 preference and 7,829 ordinary shares taken up. £3,509 14s. paid. Mortgages and charges, £3,900.

Electrico, Ltd.—F. G. Wheatley, of 102, High Street, Poole, ceased to act as receiver or manager on March 31st, 1925.

Melbourne Electric Supply Co., Ltd. (63,334).—Return dated February 4th, 1925. Capital, £1,750,000 in 150,000 5 per cent. preference shares of £5 each and £1,000,000 consolidated ordinary stock. 100,000 preference shares and £800,000 consolidated ordinary stock taken up. £1,286,445 paid on 100,000 preference shares and £786,445 consolidated ordinary stock. £14,155 considered as paid on £14,155 consolidated ordinary stock. Mortgages and charges, £1,531,133.

W. T. Glover & Co., Ltd. (56,124).—Return dated April 7th, 1925. Capital, £214,850 in 100,000 preference and 114,850 ordinary shares of £1 each. All shares taken up. £117,000 paid. £97,850 considered as paid. Mortgages and charges, nil.

Paignton Electric Light and Power Co., Ltd. (98,437).—Return dated March 24th, 1925. Capital, £40,000 in £1 shares. All shares taken up. £40,000 paid. Mortgages and charges, nil.

Charing Cross Electricity Supply Co., Ltd. (29,122).—Return dated March 24th, 1925. Capital, £2,100,000 in 400,000 preference, 900,000 ordinary, 400,000 City Undertaking preference, and 400,000 City Undertaking ordinary shares of £1 each. 400,000 preference, 576,000 ordinary, 400,000 City Undertaking preference, and 350,000 City Undertaking ordinary taken up. £1,280,000 paid. £446,000 considered as paid. Mortgages and charges, £1,426,178.

Colleys, Ltd.—Debenture dated April 17th, 1925, to secure £1,000 charged on the company's property, present and future, including uncalled capital, being a specific charge on 3-12, Marine Street, Bermondsey and all real and leasehold property for the time being. Holders: J. S. Phillips and W. M. Drake, 25, Ludgate Hill, E.C.4.

Fryer & Hartley, Ltd.—Mortgage dated April 7th, 1925 to secure £800, charged on 24, St. Mary's Gate, Rochdale. Holders: Burnley Building Society.

City Wireless Co., Ltd.—Particulars filed of £700 debentures authorised March 24th, 1925, charged on the company's undertaking and property, present and future, including unpaid capital, the whole amount being now issued.

City Notes.

Telephone Manufacturing Co., Ltd.

The annual meeting was held on April 21st, Mr. F. T. Jackson presiding. In proposing the adoption of the report (ELEC. REV., April 17th and 24th), the chairman explained the circumstances which had resulted in a loss of approximately £55,000 during the period from June, 1923, to May, 1924. He said that the loss would doubtless appear to the shareholders very extraordinary on consideration of his optimistic remarks at the last annual meeting. At that time his optimism was justified, as they had a very full order book, which showed an increase of fully 20 per cent. over the figures at the corresponding period of the previous year. Some months before the last meeting the directors had entered into preliminary arrangements for the issue of further loan capital, but although they had a written offer to make the issue, which was accepted, the usual underwriting contract had not been entered into, and in the end the arrangements did not mature. The board decided to ask a financial expert to examine the working of the business and to advise how it might best be financed on a permanent basis. That was done by a firm of accountants, but instead of resulting in any scheme for permanent finance, it resulted in a very grave attack on the principles of accountancy employed in the business of the subsidiary companies. So serious did the directors regard the question that they decided to get a written reply from the auditors, and then submit the report and the reply to Sir Arthur Whinney, the well-known chartered accountant for final decision. The result was that Sir Arthur Whinney held that their accountancy methods were correct and that opinion was supported by eminent counsel to whom the matter was referred. The effect of those circumstances was far more severe on the parent company than on the subsidiaries, because of the difference in their trading operations. The latter had a more or less fixed revenue from contracts over a period of years for a very definite goodwill. The parent company, apart from the supply of manufactured goods to its subsidiaries, was dependent on goodwill created by its advertising and the quality of its manufactures. Prior to 1921 the parent company had no sales outside its subsidiary companies worth speaking of, but by the year ended May, 1923, the outside sales were very considerable and expanded rapidly up to January, 1924. At or about the end of that month their difficulties commenced. During the following nine months the goodwill they had built up was practically destroyed; they had to cease advertising and curtail their selling organisation and factory output. The whole of the expenses incurred in opening their branches had to be written off, whereas if they had been able to continue these depôts the expenditure would justifiably have been spread over a period of years. Orders in hand were cancelled through delay in delivery. They lost orders on this account amounting to £36,500. In addition, they could not deliver orders received from their Australian subsidiary, amounting to over £60,000, through lack of finance. Unfortunately, that was not all, for many orders were given and cancelled within a few days because they could not give immediate delivery. They all knew that the cessation of advertising meant being forgotten by the buying public, but it was of no use advertising if the goods could not be delivered. The business was only saved by most drastic action in cutting down expenses. Having remarked that the position had been dealt with and that the business was proceeding satisfactorily once more, the chairman went at some length into the accounts of the subsidiary and the parent companies. The accounts showed that in spite of the fact that they could not get their full programme of economies into force before November 1st, the parent company had only made a further loss of £1,397, the

gross trading profit for the period June 1st to December 31st, 1924—seven months—was £1,000, more than for the previous twelve months. The total overhead expenses were down to about £4,000 per month, as compared with £6,000. By supplying apparatus to subsidiary companies at cost a profit of at least £8,000 had been forgone during 1924, but it would be returned in the shape of increased dividends from the subsidiaries in the future. It showed that the corner had been turned. The company was recovering and eventually would emerge stronger than it had ever been before. Since mid-December they had repaid the bankers £20,500, and since January 1st this year they had paid £21,500 to the trustees for the bondholders on account of the annual service fund of £36,780. Proceeding to deal with the present position of the manufacturing side of the business, he said that their factory was not built with the view of only supplying goods to the subsidiary companies. They had a bigger field in front of them, and delay in reaching it had been due to the troubles already alluded to and now in the past. Their products, apart from those demanded by their subsidiaries, consisted of public telephone apparatus and accessories, radio apparatus and the "Laryngaphone." They had been entrusted with contracts for important apparatus by the Post Office, and deliveries under those contracts had been satisfactory. They also had contracts in hand for one of the British Dominions, some of the most important telephone companies abroad and various Government Departments. The profit on this work was not great, but it was a stable business. In wireless apparatus they had concentrated principally on loud speakers and head telephones. These had met with a very ready demand from the wireless public. The "Laryngaphone" was making steady progress in the marine world. The marine field was not the only one applicable for this apparatus; it was being used in other fields, and had been adopted by the Government for certain purposes. As to the future, he could not prophesy, but he was quite convinced that the present position could be most speedily remedied by the development of the manufacturing side, as that side alone could most speedily provide liquid funds which would enable them to pay off their loan indebtedness quickly and restore the company to prosperity as understood by the shareholders. Great developments were in progress within the telephone service of this country; there was a large amount of manufacturing to be done, and they might confidently anticipate a share of that prosperity.

Urban Electric Supply Co., Ltd. The directors' report for 1924 states that after providing for debenture interest, &c., the balance at credit of profit and loss account is £72 920. To this is added £9,872 brought forward, making £82,792. The interim preference dividend absorbed £10,533, and the purchase of funded dividend certificates £106, leaving an available balance of £72,239, which it is proposed to allocate as follows:—Depreciation reserve, £30,000; general reserve, £5,000; writing off expenses of stock issue, £4,997; final dividend on 6 per cent. preference shares, £10,500; purchase of funded dividend certificates, £1,250; dividend of 4 per cent. on the ordinary shares, £9,600; leaving £10,892 to be carried forward. The meeting was to be held yesterday (Thursday).

South Wales Power Co., Ltd. In presenting the report and accounts at the annual meeting on April 25th, the chairman, Mr. W. North Lewis, referred to the death of Sir Leonard Llewelyn, K.B.E., one of the directors. He then explained the relations between the company and the South Wales Electrical Power Distribution Co. (the "Parliamentary" Company), and dealt with the revesting of the working and administration of the undertaking in the Parliamentary Company on January 1st undertaking in the Parliamentary Company on January 1st last. Under this arrangement, he said, the Parliamentary Company would, after paying the working and administration costs, debenture interest, &c., and making due allowance for depreciation, transfer the whole of the balance of the gross revenue to the Power Company. Turning to the report and accounts (*vide* Electrical Review, April 3rd, p. 547), the chairman said the results of the year's working were very satisfactory in view of the depressed state of industry in South Wales. The holders of ordinary stock would doubtless feel some disappointment at not receiving a dividend, but after careful consideration the directors thought that the best interests of the shareholders would be served by forming the nucleus of a substantial reserve. The great improvement shown was due to a large extent to the economies effected by the operation of the new 15,000-kW set which was started up in January last year. Delay had occurred in the erection of the high-pressure boilers, but two of these had been in use for the past month or so and the other two were practically ready for service. At the same time, the second 15,000-kW generating set was almost completed and would be running under load very shortly. Further contracts had been placed for trunk and connecting mains, including the main to Barry Docks for the supply of energy to the Great Western Railway Co. It was hoped that this supply would commence before the end of the year. Negotiations in connection with other large supplies were proceeding, and it was hoped that the company's output would be greatly increased. In conclusion, the chairman said that the directors were of the opinion that the day of the small generating unit had passed, and that every possible support and encouragement should be given to the large central stations. In their view it was largely by that means that a district like South Wales could be assisted in holding its own in the markets of the world.

Johnson and Phillips, Ltd. The report for the year ended December, 1924, states that the profit on trading account, &c., after making provision for bad debts, and after charging to revenue upwards of £24,000 for maintenance of buildings, plant, &c., was £161,965, plus £46,829 brought forward (less dividend paid May 30th, 1924, £21,875), making £186,919. Remuneration of directors, auditors, &c., requires £1,596; debenture interest, 8 per cent., £25,565; debenture sinking fund reserve, £15,217; income tax and corporation profits tax, £4,469; depreciation on machinery and plant, &c., £12,281; leaving £127,792. It is proposed to pay a dividend of 10 per cent. per annum, less income tax, on the ordinary shares, absorbing £50,000, leaving £77,792 to be carried forward. Sir Philip Dawson, M.P., has been appointed a director. Annual meeting: May 7th.

Indo-European Telegraph Co., Ltd. The annual meeting of this company, whose report was reviewed in our last issue (p. 667), was held on April 23rd. Mr. H. L. M. Tritton (chairman), in the course of his speech, referred to the death of Sir William Brooke, who had been a director for 25 years. He said that the reconstruction and repair work had been carried on during the year on sound lines so that total interruptions were very rare and seldom lasted more than 24 hours. The volume of traffic was not unsatisfactory having regard to the difficulty of regaining the confidence of customers after a long period of enforced inactivity. This confidence was being regained by the high quality of the company's service and with the improvement of facilities it should increase. Relations with the concessionary Governments had continued to be most friendly; the German concession up to December, 1954, had been obtained. Their co-operation with the Indo-European Telegraph Department of the India Office had gained for them direct Wheatstone working between the United Kingdom and Karachi, a distance of 5,300 miles. In the accounts £50,000 had been set aside towards the reconstruction of lines in Russia and Poland. The success of the year's working was indicated by the increase in the dividend from 7 to 8½ per cent. Among other allocations was the placing of £10,000 to the dividend-equalisation fund which was practically exhausted. It was the existence of a considerable sum on this account which had enabled the directors to maintain dividends at a very substantial level during the war.

Cuba Submarine Telegraph Co., Ltd. The report for the year ended December 31st last shows that the receipts amounted to £64,881, and the expenses to £27,170; the balance, after providing for cable repairs, income tax, &c., was £24,062. To this is added a difference of exchange of £4,028 and £7,106 brought forward, making £35,196. The sum of £15,000 has been added to the general reserve; and interim dividends absorbed £7,000. From the balance it is proposed to pay the final preference dividend and a final dividend at the rate of 5 per cent., free of tax, on the ordinary shares (making 5 per cent. for the year, tax free). This leaves £6,196 to be carried forward subject to corporation profits tax. The competing Government cable in the West Indies was opened for working in December last, and the subsidies allowed to the West India and Panama Telegraph Co. ceased. To prevent this company from going into liquidation the Cuba Co. acquired the whole of its debentures and shares. The board hopes that this will enable the greater part of the traffic to and from the West Indies, upon which the company is so dependent, to be maintained.

Pernambuco Tramways and Power Co., Ltd.—The gross receipts for the past year amounted to £385,159, and the net receipts (including transfer fees) to £153,499. After providing for debenture interest, sinking fund, &c., there remains a profit balance of £28,746. From this is deducted last year's deficit of £23,882, and it is proposed to carry forward the balance of £4,863. The directors report further progress. The improved position is due to the higher receipts and an improvement in exchange. Extensions will soon have to be considered in both the power and tramway departments. Meeting: May 5th.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Crittall Manufacturing Co.—61,050 (vendor) 8 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 61,050.

Application has been made to the Committee to allow the following to be officially quoted:—

American Telephone and Telegraph Co.—$3,054,800 capital stock.

Fife Tramway Light and Power Co.—500,000 ordinary shares of £1 each, fully paid. Nos. 1 to 500,000; and 500,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 500,000.

East African Power and Lighting Co., Ltd.—For the purpose of complying with Stock Exchange requirements, and not as an invitation to investors, particulars were advertised on Tuesday last of an issue of £160,000 sterling 7 per cent. 3-year registered notes at 98 per cent. The proceeds will be utilised for meeting capital expenditure incurred on a hydro-electric power plant on the Thika River with a 40,000-volt transmission line, 35 miles long, to Nairobi, which is now in course of completion.

La Plata Electric Tramways Co., Ltd.—A dividend of 3 per cent. has been declared on the 6 per cent. preference shares, bringing the payment of arrears up to February 28th, 1913.

Hadfields, Ltd.—The directors' report for the past year says that owing to the continued depression in the steel and engineering trades, the demand for the company's products has been greatly restricted. In order to maintain employment and keep the plant in operation it has often been necessary to accept orders at unremunerative prices, and this has seriously affected the year's earnings. It is considered, however, that circumstances warrant the payment of a dividend of 2½ per cent. on the ordinary shares. This will leave a balance of £80,523 to be carried forward.

Ever-Ready Co. (Great Britain), Ltd.—A preliminary announcement by the directors states that there was a net profit of £96,000 in 1924; to this is added £15,000 brought forward, making £111,000. It is proposed to pay the maximum dividend on the preference shares and a final dividend of 5 per cent. and a bonus of a similar amount on the ordinary shares, making 15 per cent. for the year, as compared with 10 per cent. for 1923. It is also proposed to transfer £35,000 to reserve and to carry forward £22,000. The meeting is to be held on May 28th.

Rangoon Electric Tramway & Supply Co., Ltd.—Out of the profits from the past year's working it is proposed to pay a final dividend of one rupee per share, free of tax, to shareholders domiciled in India and Burma, making 1½ rupees for the year. It is also proposed to place £40,000 to renewals reserve; £1,999 to depreciation; £10,000 to reserve for cables; £3,306 to employés' provident fund and bonus; £27,641 to repairs and maintenance; and £10,000 to dividend-equalisation fund; leaving £17,599 to be carried forward.

Simms Motor Units (1920), Ltd.—After providing for depreciation, &c., the profit in respect of 1924 was £27,741, to which was added £5,631 brought forward, making £33,372. It is proposed to pay a dividend of 10 per cent. (as compared with 5 per cent. in 1923) and to carry forward £21,372. The turnover is stated to have increased very substantially during the year.

County of Durham Electrical Power Distribution Co., Ltd.—Including £1,748 brought forward, the amount available for distribution in respect of 1924 is £40,324. It is proposed to pay a dividend of 6 per cent. (as in 1923) and to carry forward £2,120.

Swansea Improvements and Tramways Co.—The profit for 1924, after deducting debenture interest, &c., and allocating £5,000 to renewals, was £13 313. It is proposed to pay a dividend of 6 per cent. on the ordinary shares (as in 1923), to place £3,000 to reserve, and to carry forward £7,520.

Richardsons, Westgarth & Co., Ltd.—The report for 1924 records a profit of £48,215, and it is proposed to pay a final dividend of 2½ per cent. upon the ordinary shares, making 5 per cent. for the year, as compared with 10 per cent. in 1923, and 18 per cent. in 1922.

Philips Glow Lamp Works.—The Amsterdam correspondent of the *Financial Times* reports that the directors have declared a dividend of 16 per cent. on the ordinary shares for the past financial year, as compared with 11 per cent. in 1923, out of net profits amounting to 6,200,000 florins.

Tilling-Stevens Motors, Ltd.—The directors report a profit of £60,522 for 1924, and recommend the payment of a 7½ per cent. dividend on the preference shares.

Lima Light, Power and Tramways Co.—A dividend of 2 per cent. has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

WRITING on the eve of the Budget, it has to be noted that Stock Exchange markets are firm in the majority of cases. The only section in which noticeable weakness occurs is that for Home Railway stocks. In the case of the latter, the action of the Great Western, in notifying reduction of staff, has evoked vigorous protests from the men, and meetings are called to consider the advisability of "joint" action. The long-suffering member of the public is therefore left wondering in what way he will next be incommoded by labour difficulties. General expectation looked for the Chancellor to reduce the income tax by 6d. in the £, and the optimists professed to think that twice that amount would be removed. It was also hoped that, in one way or another, the Chancellor could announce steps to benefit the country's heavy industries, *e.g.*, the iron, coal, steel, engineering, and similar trades, which are at present labouring under a dark cloud of depression.

Babcock & Wilcox are now quoted ex dividend at 53s. 1½d., thus showing a net gain on the week, allowing for the deduction of the dividend and bonus. Industrial shares are tolerably firm throughout, though British Aluminium, Brush and Siemens lost small amounts. Siemens are 25s. middle. There are still to be obtained a moderate number of the company's 10 per cent. preference shares at 29s. 6d., on which basis the return is £6 13s. 4d. per cent. on the money, with dividends due in January and July. Metropolitan-Vickers ordinary and preference are both ex dividend, and the former have recovered part of the amount. Edisons are a shade harder at 7s. 9d. middle: the first debenture rose to 83.

The Urban Electric Supply Co. announces a dividend of 4 per cent. on the ordinary shares. The net profit for the year 1924 was £72,900, which shows a reduction of about £1,300 as compared with the previous period. The price of the shares remains unchanged at 1$\frac{1}{16}$. Edmundsons are steady at 24s. 6d. Midland Counties have strengthened to 24s. 3d., the shares being steadily absorbed by purchasers who are content to take a modest rate of interest on their money for the time being in the hope of obtaining a substantial improvement as the company expands in the manner for which there exists wide scope.

The list of home electricity supply shares is quiescent. St. James's rose to 13½, and Westminster ordinary to 44s., or equivalent to £11 for the shares in their previous state of £5 each. No other alterations have occurred throughout the list. Whitehall Electric preference went back a few pence, while the debenture stock holds its previous rise at 98 middle. The Madras Electric Supply Co.'s issue of 5½ per cent. tax-free preference, offered a couple of weeks ago at a guinea, was left partially in the hands of the underwriters, who were, however, offered relief from their liability if they chose to accept it rather than to take up the shares. A market has been started in these shares on the basis of 20s. 9d., at which they can be bought free of stamp and fee. The prospectus showed the dividend to be well covered on the profits set out, and, as the return is a little over 5¼ per cent., free of tax, it is probable that the shares will soon find a permanent home. Shropshire, Worcestershire, and Staffordshire preference are offered at 22s., to pay 5½ per cent. on the money, and in the case of these shares the dividend was covered, according to last year's profits, about seven times over. The supply of debenture stock in this market continues to shrink, and there is very little stock available in the best-class companies.

Signs are not wanting that the cable industry is doing a good deal better, and no doubt it is the knowledge of this which serves to quicken the demand for Eastern stocks, as well as that for others in the list. There is no change in prices, however, the only movement of consequence in the catalogue being another gain of £2 in Indo-European, thanks, of course, to the increased dividend which brought about the improvement of £5 per share last week. The yield on the money on these shares is now less than can be obtained from the stocks and shares of the Eastern quartette.

Automatic Telephones strengthened to 2, and the new shares are better at 39s. There has been a little inquiry for International Automatic Telephones, where the price improved to 25s. 6d., the new shares being quoted at a trifle less than this. The Marconi group is heavy. As previously mentioned, it is thought that the late Mr. Godfrey Isaacs may have been a considerable shareholder in the Marconi Company, and the apprehension is, therefore, that his shares may come to market. The price is ¼ down at 32s. 6d., and the new shares eased off to 4s. 6d. premium. Canadian Marconis drooped to 5s. 1¼d. Chili Telephones have gone back a shade.

One of the latest introductions to the miscellaneous market of the Stock Exchange is the capital stock, in shares of $100 each, of the International Telephone & Telegraph Corporation. This is a New York company, the shares being officially quoted in Wall Street. The corporation is paying 6 per cent. dividends. It is a holding concern, and owns the bulk of the common stocks of the Cuban Telephone Co. and of the Porto Rico Telephone Co. It has recently completed the organisation of the Spanish National Telephone Co., and from this branch of the business the International Telephone is expected to draw substantial benefits. The price of the shares is 94.

Manila Electric has enjoyed a mysterious rise of some 8 points within the past week or so, the price now being 48½. The buying has proceeded in part from people said to be in close touch with New York. Anglo-Argentine Tramways second preference have gone back to 2½. Brazilian Tractions, on the other hand, put on 1½ to 53½ ex dividend. In the London list, the preference shares of the London & Suburban Traction Co. are again better, owing to the regulation of traffic in the Metropolis. This is expected to give the tramway undertakings a chance to do better than they did under the unhappy conditions of last year.

Districts have gone back to 48½, and Underground £10 shares to 2½. Metropolitans gave way to 76, but rallied to 77.

The rubber share market still suffers from a sort of sleeping sickness, and, in spite of a weekly improvement in the commodity's statistical position, the interest taken in the market by the public is so meagre as to forbid any semblance of activity in share prices.

Share List of Electrical Companies.

	Nom.	Dividend. 1923.	Dividend. 1924.	Price April 27 1925.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.	£					
Bournemouth and Poole ...	1	18	14	21⅜	—	4 19 7
Brompton Ordinary	1	10	10	1⅝	—	*5 14 3
Charing Cross Ordinary	1	14½	15	45/-	—	6 13 4
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	38/9	—	6 4 0
City of London	1	15	15	2 7/16	—	6 9 10
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	15	2⅝	—	5 9 1
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	—	24/6	—	5 14 2
do. 7% Pref.	1	6	—	23/-	—	6 1 9
Elec. Supply Corporation ...		10	10	31/3	—	6 8 0
Kensington Ordinary	5	14	15	12⅜	—	5 18 10
Lancs. Light and Power ...	1	7½	7½	28/-	—	5 7 1
London Electric	1	10	10	36/6	—	5 12 8
do. do. 6% Pref. ...	5	6	6	5 7/16	—	5 7 7
Metropolitan	1	10	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	24/3	+6d.	4 19 0
Newcastle-on-Tyne Ordinary ...	1	6	7	23/9	—	5 17 11
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	11xd	+6d.	5 6 8
St. James' and Pall Mall ...	5	17½	17½	13½	+ ½	6 9 8
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref. ...		7	7	1½	—	5 19 0
Urban Ordinary	1	4	4	1 3/16	—	3 15 4
do. 6% Pref. ...	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	44/-	+6d.	6 16 4
Whitehall Elec. Invst. 7½% Pref.*	1	7½	7½	19/6	—9d.	7 13 10
Yorkshire Elec.	1	8	8	30/6	—	5 5 0
HOME RAILS.						
Central London Ord. Assented Stock	4	4		69	—	5 15 11
Metropolitan ... ... ,,	4	5		77	—	*6 9 10
do. District ... ... ,,	3½	3½		48½	— ½	7 4 4
Underground Electric Ordinary	10	Nil	Nil	2⅜	— ⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	6/-	—	Nil
do. do. Income Bonds	6	6		97	—	*6 3 9
TELEGRAPHS AND TELEPHONES.		Dividend. 1922.	1923.			
Anglo-Am. Tel. Pref. ... ... Stock	6	6		104½xd	+ ½	5 14 10
do. Def. ... ... ,,	1½	1½		24	—	6 5 0
Automatic Telephone 1	Nil	3		2	+ ¼	3 0 0
Chili Telephone	5	6	6	5 1/16	— 1/16	*5 10 4
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17½	—	*5 14 3
Eastern Tel. Ord. ... ... Stock	10	10		177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	32	—	6 17 6
Indo-European	25	7	7	20½	+2	*5 7 7
Marconi	1	15	10	1⅝	— ¼	6 3 1
Marconi Marine	1	10	10	1⅛	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	2⅛	—	*5 12 11
United R. Plate Tel.	5	8	8	7 1/16	—	*5 18 3
Western Telegraph	10	10	10	17½	—	*5 15 11
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref. ...	5	12½	5½	8½	—	8 9 2
do. do. 2nd Pref. ...	5	5½	6	2⅜	— ⅛	10 7 10
do. do. 5% Deb. ...	Stock	5	5	78	—	6 17 0
British Electric Traction Ord. ...	,,	5	6	107½	—	5 11 7
do. do. 6% Pref. ...	,,	6	6	107½	—	5 11 7
Brazil Traction	100	4	4	53½xd	+1⅛	7 9 7
Brit. Columbia Elec. Ry. Pce.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	5	96/-	89½	—	*5 7 3
do. do. Deferred	,,	8	129/3	107½	—	*6 0 6
do. do. Deb.	,,	4½	4½	78½	—	5 8 3
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/6	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—	8 8 5
Mexico Trams, 5% Bonds ...	—	Nil	5	66	—	7 11 6
Mexican Light Common ...	100	Nil	Nil	26	—	Nil
do, Pref.	100	Nil	Nil	61	—	Nil
do. 1st Bonds ...	—	5	5	66½	—	7 10 5
Yorkshire (West Riding) ...	1	—	5	1	—	5 0 0
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	20	12	2⅛	+ 1/16	* 4 10 4
British Aluminium Ord.	1	5	5	22/-	—6d.	8 2 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6xd	+6d.	... ...
British Insulated Ord.	1	15	15	8 1/16	—	4 17 11
Brush Ord.	1	10	10	25/9	—6d.	6 4 3
Callenders	1	15	15	38	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅛	—	... ...
Edison-Swan	4/-	7½	10	7/9	+3d.	5 1 3
do. 5% Deb.	Stock	5	5	83	+1½	6 0 6
Electric Construction	1	10	10	33/9	—	5 19 10
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	8	5	18/3	—	5 9 7
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	22/-	—	4 16 11
Henley	1	15	15	3 3/16	—	4 14 1
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	20/-	—	*5 0 0
Johnson & Phillips	1	5	5	1⅜	—	3 1 6
Mot-Vickers, Ord....	1	12½	8	23/9xd	+6d.	6 14 9
do. Pref....	2	8	8	2⅜xd	—	6 14 9
Siemens Ord.	1	5	—	25/-	—9d.	4 0 0
Telegraph Construction	12	20	20	27	—	*4 14 1

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price April 28.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	8¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£33	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4¼d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£215	...
Grade II ... ... ,, ,,	£155	...
Grade III ... ... ,, ,,	£80	...
c Brass (rolled metal 2" to 12" basis) per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	...
c ,, Bars (best selected) ... per ton	£91	£1 inc.
c ,, Sheet ... ... ,,	£91	£1 inc.
c ,, Rod ... ... ,,	£91	£1 inc.
d ,, (Electrolytic) Bars ... ,,	£85 5s.	5s. inc.
d ,, Sheets ... ... ,,	£143 10s.	...
d ,, ,, Wire Rods ... ,,	£75 10s.	10s. inc.
d ,, ,, H.C. Wire per lb.	9 7/16 d.	½d. inc.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f ,, Sheet ... ... ,,	2/- to 3/6	...
g German Silver Wire ... ... ,,	2/8	...
h Gutta-percha, fine ... ... ,,	2/-	6d. dec.
h India-rubber, Para fine ... ... ,,	1/7	...
i Iron Pig (Cleveland Warrants) ... per ton.	nom.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£26	...
g Lead, English Pig ... ... ,,	£24 15s.	20s. dec.
g Mercury ... ... per bot.	£13 10s. - £13 15s.	...
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/9½	...
p ,, ,, wire ... ... ,,	1/3½	...
c Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
a Tin, Block (English) ... ... per ton.	£247 7s. 6d. to £247 17s. 6d.	£16 7s. 6d. inc.
a ,, Wire, Nos. 1 to 16 ... ... per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd
m P. Ormiston & Sons.
o Johnson, Mathey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W F Dennis & Co

E.P.E.A. Dinner.—The annual dinner of the Hull Sub-Section of the E.P.E.A. was held at Powolny's Restaurant, Hull, on Saturday, April 18th, Mr. W. Jones presiding. Councillor Pearlman, the deputy chairman of the Hull Corporation Electricity Department, in proposing "The E.P.E.A.," said that it was only by an organisation such as that of the power engineers, and by improving the calibre of the men who were to carry on the work, that electricity undertakings in this country would become gigantic in relation to their present size. In order to popularise electricity it must be generated and sold cheaply, and that necessitated competent men in charge. Major Bell, manager of the Hull Corporation Electricity Department, proposed "The National Joint Board." He said he knew of no more hopeful thing for the industry than the desire to see a training scheme established. Mr. A. Waddell, chairman of the West Yorkshire Section, said it was the aim of the Association to assist and further the electrical industry. Mr. E. S. Rayner, manager of the Hull Tramways, said the engineers' organisation had enormous power. He wished to warn it to be careful how it used that power, for there was greater power in public opinion.

Electricity in Mines. — In a lecture before the Past and Present Mining Students' Association at the Wigan Mining and Technical College, Mr. R. M. Chalmers said that in Lancashire there are in all 253 mines at work and exactly half of them employ electrical equipment to the extent of 68,398 horse-power, of which 55,485 horse-power is located below, and 32,913 horse-power on the surface. These figures, in his opinion, present sufficient justification f r added interest being taken in electrical technology an1 the safe application of electrical power in mines.

The National Physical Laboratory.

Annual Report: Continued Progress.

(*Concluded from page* 651.)

In connection with the development of a standard tester for horseshoe magnets by the British Engineering Standards Association, a number of magnets have been very carefully tested with a view to their use as calibrating standards in the tester. In the course of this work an investigation has been made into the accuracy of the methods of testing permanent magnets of this type, and some interesting results have been obtained, of which it is hoped to publish an account shortly.

In the electrotechnics division (alternating current) the amount of test work has occasionally been more than could be dealt with in a reasonable time. The installation of duplicate standard apparatus which is in progress has taken longer than was expected, and the construction of subsidiary apparatus has been somewhat delayed owing to the pressure of routine work requiring a large amount of the time of the staff which would otherwise have been available for the construction and adjustment of new apparatus. Additional potential dividing resistances are being constructed; when completed the department will have nine resistances for high-voltage measurements, each rated at an average of 6,000 volts. One of their uses will be for the investigation of capacity errors in resistances of this character at 30 to 60 kilovolts. A considerable number of other special resistances used for current, power, and phase-angle measurements are also in hand.

Accuracy in Technical Measurements.—It is interesting to note that there have been inquiries from many sources on the subject of the limitations of methods of measurement and instruments, especially as regards the measurement of power under certain conditions in which serious errors are liable to occur. The experience necessary for rendering assistance on many such matters is hardly available except at the laboratory. Discussions on these subjects have taken place with instrument makers and with members of the staff of several manufacturers of large plant. In the past the demand for the highest accuracy in testing commercial types of instruments has been to a considerable extent due to the stringent requirements laid down for the performance of steam turbines which still continues, but other aspects are demanding an equally high accuracy under even more difficult conditions. Among these are the determination of the characteristics of large power transformers of several thousand kilowatts, up to 110,000 volts, which are frequently designed so as to have a high reactance, with the result that, the efficiency being high, measurements of internal power losses have to be carried out at a very low power factor, sometimes about 5 per cent. The instrumental difficulties are liable to be particularly serious when the current is large, and the errors involved may be a considerably larger fraction of the indication of the instruments than is desirable. A very material improvement has been effected in this respect, during the past year or so, in the design of the highest classes of precision wattmeters used for such measurements as a result of discussions with the manufacturers as to the causes of error and the best method of eliminating them. The subject is becoming of great commercial importance, since modern power plant is usually required to give a very definite performance, and ignorance of the possible intrinsic errors of various types of instruments may lead to serious technical and commercial difficulties. Accuracy is specially important in much of the work which is for export, and any inferiority will have a serious effect on the prospects of further orders.

Another interesting cause for the requirement of high accuracy in technical measurements is the growth of automatic substation plant. For the starting of alternating-current plant to be carried out satisfactorily, the subsidiary apparatus has to be accurately designed to suit it, and a knowledge of the electromagnetic characteristics over the whole range of starting is necessary for the purpose. Here, again, the accurate measurement of power at very low power factors is required, complicated by the fact that the information necessary is required over a wide range of speed and applied voltage.

As mentioned in previous reports, a very considerable number of instruments which are sent for test to the laboratory, are found to be outside the recognised limits as regards error of indication. The laboratory makes use of the British Engineering Standards Association's specifications in deciding on the performance required for certification. The causes appear to be sometimes an insufficient study of the characteristics of the type of instrument manufactured. For instance, a not uncommon defect is error due to temperature rise caused by the application of current or voltage. There is no doubt that there has been in some cases a want of appreciation of the relative importance of the various factors which enter into the engineering compromise which constitutes a satisfactory instrument, and that the optimum conditions of design and operation have by no means been achieved. There is, however, good reason to believe that a more scientific method is, in general, now being applied to the study of instrument design and performance. For ensuring a more satisfactory standard of accuracy and adjustment in many of the instruments sent to the laboratory, and for the general assistance of instrument designers and manufacturers, a series of notes on the subject is in preparation, giving information as to the more common defects found in instruments of different types. It is hoped that this may result in a material improvement in the instruments submitted and help to avoid the present serious loss of time, to the advantage of all concerned. It is believed that, in distinction to nearly all other branches of electrical engineering, instrument making has suffered seriously in the past from want of adequate literature on the subject.

High Voltage Laboratory.—The consideration of the building and equipment for the high-voltage laboratory has been continued, the proposal being that plant capable of giving 600,000 volts three-phase and 1,000,000 volts single-phase should be allowed for. Building operations were begun early in September and it is expected that the construction will occupy about a year. The transformer equipment specification was issued early in the summer. Before coming to a definite decision, however, it has been thought desirable to allow time for obtaining farther information, since rapid developments have taken place during the last year or two in the construction of high-voltage laboratories and plant, especially in America, where at least three new installations to give a million volts, in addition to plant in manufacturers' works, are under construction or have been recently completed. An opportunity occurred of seeing in operation a newly-erected plant for a million volts in Paris, which is believed to be the first one of this size erected in Europe. The behaviour of this plant has been of very material assistance in coming to a decision as to the size of building necessary for the purpose.

Engineering Department.—In addition to lubrication and bearing surfaces investigations, a large number of tests have been carried out with the Rosenhain combustion calorimeter during the year, chiefly upon coals for electric power stations. The bomb calorimeter has now been re-constructed with a view to greater convenience in use. There does not appear to be any reason to suppose that greater accuracy can be obtained with the bomb than with the Legros type of combustion calorimeter, such as the Rosenhain, in which the total radiation corrections can be made very small, while the danger of incomplete combustion does not seem to be greater than with the bomb calorimeter. There is no doubt that a more promising form of apparatus for tests of this kind would be a continuous flow calorimeter in which the powdered coal is burnt at a jet. It would be possible in this way to make use of larger samples of coal, which would be of great practical advantage.

Regarding the efficiency of steam pipe covers and heat transmission from pipes, no covers of outstanding merit have been tested. The efficiency of the cover appears to be similar to that obtained from pipes filled with steam in the usual manner. A series of tests has been carried out, for a firm making a protective compound for boiler tubes, upon the heat loss from bare tubes and tubes covered with this compound. The most important observation was the extremely rapid falling off in the heat transmitted by the bare pipe as its surface became coated with rust. The effect of painting such a surface was to increase the heat transmission. The experiments are interesting as showing the very variable heat transmission due to surface conditions.

Metallurgy Department.—While increases in electrical equipment will provide very necessary additional power for electric furnace purposes, and will, it is hoped, enable the existing Ajax-Northrupp high-frequency induction furnace to furnish a better output than is possible with its present a.c. supply, the need for a much larger high-frequency furnace still remains. It is hoped that it may be possible in the near future to meet this by the installation of a rotary high-frequency current generator which has recently become commercially available. The existing furnace has meanwhile been appreciably improved by fitting a new spark-gap operating in an atmosphere of hydrogen, while an exhaust fan has been installed for removing the mercury vapour generated by the spark-gap. Several new high-frequency furnaces of a special small experimental type have been built and put to successful use; these have proved particularly important in connection with the alloys of iron research. The electrical equipment of the laboratory (apart from the foundry) has been improved, and the production of considerable quantities of pure chromium metal by electrolysis (alloys of iron) has rendered necessary the construction of a special eletrolytic cell for work of this kind which constitutes a permanent addition to the equipment of the Department.

Further progess has been made with the production of pure chromium and of iron-chromium alloys free from carbon. With regard to pure chromium it has been found very difficult to utilise the electrolytically prepared metal, which is at present obtained in the form of fine flakes, for direct melting in the high-frequency electric induction furnace, the small flakes being insufficient to form a satisfactory circuit for the induced currents. Treatment of the flakes by annealing in order to facilitate compression into more compact masses has so far proved unsuccessful, and special devices for melting this material will have to be employed. There is, however, no difficulty in dissolving this chromium in molten iron, so that the

problem does not apply to the production of iron-chromium alloys containing any appreciable amount of the former metal.

The preparation of metallic manganese by an electrolytic process has proved extremely laborious and slow, while an additional difficulty has presented itself in the fact that manganese thus produced tends to oxidise very rapidly when exposed to air, even in the absence of moisture and carbon dioxide. Other methods of preparing pure manganese have been sought, and the rudiments of a satisfactory method have been found in the distillation of manganese from molten impure manganese containing small amounts of aluminium and silicon. Slightly impure manganese of this kind can be readily prepared by alumino-thermic reduction from purified manganese oxide, but the degree of purity obtainable in this way is not particularly high. It has, however, been found that, by melting an impure manganese of this kind in the high-frequency electric furnace, while a good vacuum is maintained, the manganese distils off and can be collected on a suitably arranged condensing surface, where it forms a massive layer which, on analysis, shows that only traces of silicon or aluminium are carried over with the distillate. In this way adequate quantities of pure metallic manganese can readily be prepared, thus producing satisfactory material for the study of the iron-manganese system of alloys and also for the study of the properties of pure metallic manganese, a metal which has not hitherto been obtainable in any high degree of purity.

The whole of the melting, as well as some of the heat treatment required in connection with this research (alloys of iron) has been done by means of the Ajax-Northrup high-frequency electric furnace. In the course of this work much useful experience has been gained from the manipulation of the furnace, the construction of special furnaces for use with high vacuum, and the avoidance of many of the experimental difficulties which arose when the furnace was first employed.

The effort to produce beryllium in a state of higher purity has been attacked in several directions, notably by improving the purity of the graphite used both as container and electrode in the electrolysis of the fused beryllium salts, and by avoiding by special methods the disintegration of this graphite in order to prevent the formation of a carbonaceous scum upon the surface of the bath which tends to contaminate the beryllium metal with carbon or carbide. Changes in the methods of electrolysis have also been tried with a view to securing the production of the deposited beryllium metal in a more regular and sounder form. A considerable amount of beryllium metal of a fair degree of purity has been prepared, and its properties and behaviour studied in various ways. One remarkable feature of the metal is that, although readily attacked by warm water, it retains its brightly polished surface for a long time without tarnishing when exposed to the air in the ordinary way. It is hoped that when the process of purification has been carried further a workable metal will be obtained. For this purpose it will be essential to use metal which has been remelted subsequently to electro-deposition, and melting in the high-frequency induction furnace appears to be necessary.

Photometry Division.—The number of lamps sent for standardisation has formed a larger proportion of the total tested than was the case in 1923 and last year's increase in the number of lamps submitted for measurement of the mean spherical c.p. has continued. The need for satisfactory lamps for use as sub-standards in the measurement of gasfilled lamps is becoming more acute. The British Thomson-Houston Co. recently submitted some 100-watt gasfilled lamps for investigating their suitability for use as standards of mean spherical candle-power. The lamps seem to promise well as regards the rate of fall of candle power during life, and the research laboratories of the General Electric Co. have submitted two further experimental lamps, having the spiral filaments mounted in one plane.

For some years photo-electric cells have been employed for stellar photometry, but it is only comparatively recently that any work has been done to ascertain their value for precision candle power measurement. The reason for this delay appears to lie in the lack of constancy of the photo-electric currents in gasfilled cells. Recently, however, the General Electric Co. produced vacuum photo-electric cells of sodium, potassium, and rubidium, whose characteristics appear to vary very little with time, although different cells of the same type show somewhat different characteristic curves. In using photo-electric cells for candle power measurement it is very necessary, on account of the difference between the sensibility curve of the normal eye and those of the various types of cell used, to define very carefully what is meant by candle power and also what is the signification of the magnitude of the photo-electric current from the cell employed. On account of the different scales of luminous power, in comparing the visual c.p. of two lamps by photo-electric methods, the spectral distribution of the standard and test lamps must be the same. Now with tungsten vacuum lamps it is possible to obtain the same spectral distribution by suitably adjusting the voltage, so that it is only necessary when comparing sub-standard lamps by photo-electric means that they should be run at a voltage at which they colour-match the standards. This colour matching can be done visually to an accuracy in voltage of about 1 per cent.; with an error of this amount in the colour-match voltage the rubidium cell would give results for c.p. which would be in error by 0.25 per cent. This was arrived at experimentally and by calculation, using the sensibility curves of the rubidium cell and the eye and the spectral energy distributions given by Wien's formula for black body radiators at 2,200 and 2,400 deg. K.; the corresponding ratio for the rubidium candle powers was found to be about 1.06x, where x denotes the ratio visual c.p. at 2,400 deg. K to visual c.p. at 2,200 deg. K. The voltage change in tungsten lamps for this change of temperature is about 25 per cent. of the mean voltage, so that 1 per cent. error in colour-match voltage means an error of 0.25 per cent. in determinations of c.p. by means of rubidium cells.

Experiments indicate that a photo-electric method of colour matching will probably be much more sensitive than the visual method. A rubidium and sodium cells are arranged in bridge position so that the photo-electric currents from one cell balance those of the other. The anode of one cell is maintained at a potential of +100 and the cathode of the other at −100 volts; the other cathode and anode are connected together and to a pair of quadrants of a Dolezalek electrometer which are initially earthed. The standard lamp is placed so that it illuminates both cells, and the aperture of the more sensitive cell is then partially closed until the electrometer gives no deflection on releasing the quadrants. The test lamp is then placed in exactly the same position as that occupied by the standard and its voltage adjusted until a balance of photo-electric currents is obtained.

Preliminary tests show that with a 60-watt lamp 11 ft. from the cells a colour difference corresponding to 1 per cent. in voltage is easily measurable. Since different lamps have very different polar curves, it is essential that the angle subtended at the lamp by the distance between the two cells be as small as possible, and thus it was considered useless to bring the lamp nearer to the cells. In photo-electric photometry measurements, the greater the intensity of the light on the cell the greater will be the accuracy of the measurements if a null method is employed.

Accordingly, for colour matching, a 4-ft. cube is being built which will enable greater intensities of light to reach the apertures of the two cells, which will be placed as close as possible to each other at the top of the cube and shielded from the direct light. By the use of this cube it is expected that a colour difference of 0.1 per cent. in voltage will be easily detected and that, consequently, any colour difference errors in subsequent candle power measurements will be reduced to less than 0.025 per cent. The N.P.L. is indebted to the research laboratories of the General Electric Co. for the supply of cells and for much helpful co-operation in the early stages of the work.

The Electrical Trade of Holland.

THE following statement, showing the imports and exports of electrical and similar goods into and from Holland during the year 1924, is compiled from the recently-issued statistics. The figures for 1923 are added for purposes of comparison and notes of any increases or decreases are given.

IMPORTS.

	1923. Florins.	1924. Florins.	Inc. or dec. Florins.
Electric generators, motors, transformers and rotary converters.—			
Total	6,010,000	5,172,000	− 838,000
From Germany	4,226,000	2,774,000	−1,452,000
,, Great Britain	535,000	676,000	+ 141,000
,, Switzerland	347,000	743,000	+ 396,000
,, Belgium	355,000	350,000	− 5,000
,, United States	145,000	342,000	+ 197,000
Wireless apparatus.—			
Total	757,000	1,214,000	+ 457,000
From Germany	484,000	448,000	− 36,000
,, Great Britain	135,000	285,000	+ 150,000
,, France	50,000	224,000	+ 174,000
Telegraph and telephone apparatus.—			
Total	5,182,000	4,221,000	− 961,000
From Germany	2,102,000	1,688,000	− 414,000
,, Belgium	1,477,000	319,000	−1,158,000
,, Sweden	1,285,000	1,920,000	+ 635,000
Other electrical apparatus and instruments.—			
Total	4,980,000	4,141,000	− 839,000
From Germany	3,822,000	3,043,000	− 779,000
,, Sweden	400,000	115,000	− 285,000
,, Great Britain	297,000	408,000	+ 111,000
,, United States ...	113,000	215,000	+ 102,000
Steam boilers.—			
Total	2,528,000	3,635,000	+1,107,000
From Germany	462,000	2,045,000	+1,583,000
,, Great Britain	1,745,000	1,181,000	− 564,000
Portable electric generating sets.—			
Total	6,000	—	− 6,000
Electric cable, insulated.—			
Total	6,273,000	5,844,000	− 429,000
From Germany	5,087,000	5,015,000	− 72,000
,, Belgium	*	304,000	—
,, Great Britain	*	225,000	—

	1923. Florins.	1924. Florins.	Inc. or dec. Florins.
Steam engines and turbines.—			
Total	2,127,000	2,141,000	+ 14,000
From Germany	1,135,000	703,000	− 432,000
„ Great Britain	422,000	599,000	+ 177,000
„ Belgium	126,000	211,000	+ 85,000

EXPORTS.

Electric generators, motors, transformers and rotary converters.—			
Total	1,909,000	2,974,000	+1,065,000
To Germany	153,000	336,000	+ 183,000
„ Belgium	588,000	720,000	+ 132,000
„ Dutch East Indies ...	296,000	754,000	+ 458,000
„ Spain	60,000	98,000	+ 38,000
„ South Africa	193,000	169,000	− 24,000
Wireless apparatus.—			
Total	254,000	402,000	+ 148,000
To Germany	*	65,000	—
„ Great Britain	*	157,000	—
„ Dutch East Indies ...	*	64,000	—
Telegraph and telephone apparatus.—			
Total	326,000	285,000	− 41,000
To Great Britain	153,000	*	—
„ Dutch East Indies ...	85,000	*	—
Other electrical apparatus and instruments.—			
Total	708,000	995,000	+ 287,000
To Germany	41,000	*	—
„ Belgium	93,000	*	—
„ Dutch East Indies ...	399,000	*	—
„ Great Britain	75,000	*	—
Steam boilers.—			*
Total ... * ...	944,000	1,652,000	+ 708,000
To Dutch East Indies ...	810,000	879,000	+ 69,000
Insulated copper wire and cable.—			
Total	2,512,000	2,918,000	+ 406,000
To Belgium	205,000	*	*
„ Great Britain	434,000	*	*
„ Dutch East Indies ...	413,000	*	*
„ Norway	52,000	*	*
„ Denmark	205,000	*	*
„ China	126,000	*	*
Metal filament lamps.—			
Total	25,816,000	25,076,000	− 740,000
To Belgium	1,450,000	1,167,000	− 283,000
„ Great Britain	1,232,000	1,271,000	+ 39,000
„ France	3,973,000	3,990,000	+ 17,000
„ Italy	2,142,000	2,088,000	− 54,000
„ Spain	918,000	627,000	− 291,000
„ Argentina	4,611,000	1,263,000	−3,348,000
„ Brazil	987,000	875,000	− 112,000
„ Canada	1,030,000	508,000	− 522,000
„ Australia	1,208,000	1,847,000	+ 639,000
„ Dutch East Indies ...	421,000	505,000	+ 84,000
„ Russia in Europe ...	177,000	2,413,000	+2,236,000

(Florin or Guilder = about 1s. 8d.)

* Not separately distinguished.

Indian Electrical Imports in 1924.

(From Our Indian Correspondent.)

THE following are the figures of the electrical imports into India during the calendar year 1924. In accordance with our usual practice we also show the 1923 figure and the increase or decrease for each item :—

	1923. Rs. lakhs.	1924. Rs. lakhs.	Inc. or dec. Rs. lakhs.
Electrical machinery.—			
Totals	209.5	199	− 10.5
Control and switchgear	25.7	37.7	+ 12.0
Generators, alternators & dynamos	38.6	33	− 5.6
Motors	77.5	42.6	− 34.9
Transformers	13.2	14.5	+ 1.3
Turbo-generator sets	7.7	7.4	− 0.3
Other machinery	46.8	63.7	+ 16.9
From United Kingdom	147.6	169.8	+ 22.2
„ Sweden	6.5	1.6	− 4.9
„ Germany	2.2	4.9	+ 2.7
„ United States	43.7	13.8	− 29.9
Electric fans and parts thereof.—			
Totals	27.5	25.4	− 2.1
From United Kingdom	16.8	12.4	− 4.4
„ Italy	4.3	5.3	+ 1.0
„ United States	3.7	2.8	− 0.9
Electric wires and cables, rubber insulated.—			
Totals	27.97	23.61	− 4.36
From United Kingdom	24.8	21.8	− 3.0
„ Germany	0.7	1.1	+ 0.4
„ Netherlands	0.3	0.1	− 0.2
„ United States	1	0.4	− 0.6
Insulations other than rubber.—			
Totals	25.8	17.6	− 8.2
From United Kingdom	22.2	16.1	− 6.1
Telegraph and telephone wires and cables.—			
Totals, practically all from United Kingdom	3.7	6.1	+ 2.4
Bare copper wire (electrolytic).—			
Totals	8.2	14.8	+ 6.6
From United Kingdom	7	14.1	+ 7.1
All electric wires and cables detailed above.—			
Totals	65.8	62.4	− 3.4
From United Kingdom	57.7	58	+ 0.3
„ Germany	1.7	2	+ 0.3
„ Netherlands	0.8	1.2	+ 0.4
„ Japan	0.7	0.2	− 0.5
„ United States	3.3	0.5	− 2.8
Telegraph and telephone instruments and apparatus.—			
Totals, practically all from United Kingdom	26.4	11.9	− 14.5
Electric glow lamps.—			
Totals	14.3	12.4	− 1.9
From United Kingdom	6.2	3.9	− 2.3
„ Germany	2.2	1.8	− 0.4
„ Netherlands	4.8	5.4	+ 0.6
„ United States	0.2	0.2	− —
Electric lamps, other sorts.—			
Totals	6.3	3.6	− 2.7
From United Kingdom	1.9	0.6	− 1.3
„ Germany	1.4	0.7	− 0.7
„ United States	2	1.9	− 0.1
Batteries.—			
Totals	5.3	6.9	+ 1.6
From United Kingdom	3.1	3.7	+ 0.6
„ United States	1.6	2	+ 0.4
Carbons, electric (including furnace electrodes).—			
Totals, practically all from United Kingdom	0.6	0.7	+ 0.1
Accumulators (including parts).—			
Totals	2.7	8.6	+ 5.9
From United Kingdom	2.1	6.9	+ 4.8
„ United States	0.5	1.5	+ 1.0
Electric lighting accessories and fittings (including switches).—			
Totals	9.1	13.4	+ 4.3
From United Kingdom	7	8.9	+ 1.9
„ Germany	1.5	1.5	—
„ United States	0.3	2.5	+ 2.2
Electrical instruments (other sorts).—			
Totals	0.7	1.5	+ 0.8
Electromedical apparatus.—			
Totals	0.9	1	+ 0.1
Switchboards.—			
Totals	6.2	4.7	− 1.5
From United Kingdom	3.7	4.6	+ 0.9
„ United States	2.2	0.1	− 2.1
Unenumerated electrical goods.—			
Totals	43	32.5	− 10.5
From United Kingdom	31.8	21.6	− 10.2
„ Germany	5.7	6	+ 0.3
„ Italy	0.2	0.2	—
„ Japan	0.9	1.1	+ 0.2
„ United States	3.4	3	− 0.4
All electrical instruments and apparatus.—			
Totals	215.5	193.3	− 22.2
From United Kingdom	163	139	− 24.0
„ Germany	16.6	20.5	+ 3.9
„ Netherlands	6.3	7.1	+ 0.8
„ Italy	5.1	5.8	+ 0.7
„ Japan	2	1.6	− 0.4
„ United States	18	16.3	− 1.7

Eliminating X-Ray Dermatitis.—According to the *Morning Post*, a discovery has been made by Messrs. J. Risler and P. Mondain which may enable X-rays to be rendered harmless. The two scientists referred to conceived the idea of utilising the antagonism of infra-red rays towards radiations of shorter wave length. Living tissues that were submitted to X-ray emanations and afterwards exposed to the action of the infra-red rays showed no signs of X-ray dermatitis or any essential alteration. Subsequent applications in cases of X-ray dermatitis resulted in cures after three or four tests. The inventors utilise a filter made of plastic material which passes only red and yellow rays.

The Nation's Food Exhibition.

A NUMBER of matters of interest to electrical men are open to inspection at the Nation's Food Exhibition at Olympia, which ends to-morrow (Saturday). The exhibition deals mainly with the production and preparation of all kinds of foods, but there are a number of digressions from the principal objects. We will not attempt to describe all the machinery which is electrically operated; the following notes refer only to exhibits which are more strictly electrical.

General Electric Co., Ltd.

This exhibit is one of the most interesting in the show, from an electrical point of view. A great deal of large cooking apparatus is displayed, and demonstrated in a practical manner. The most striking feature is a large bread-baking oven (fig. 1) capable of taking 36 half-quartern loaves at a time. The cooking space measures 4 ft. square by 1 ft. high. The total loading is 9.6 kW. The oven is constructed with a cast-iron door, door frame, &c., and with a sheet steel body double-cased and heavily lagged. The oven is of the tiled hearth type arranged with top and

Fig. 1.—A G.E.C. Bread-baking Oven.

bottom heat. The heating elements are inserted from the side of the oven, the wiring being arranged so that the poles are at either end of the element, and by disconnecting at both ends the element can easily be removed. The bottom elements are fitted below the tiled flooring, and the top elements are screened to prevent contact with the steam produced in baking operations. The door is fitted with suitable balance weights, and the oven is raised from the floor on legs to a convenient height for easy working. Three-heat series-parallel control is arranged for by means of suitable switches mounted on the body of the oven. Among the equipment suitable for restaurants is a cabinet type roasting oven, with a total cooking space of 52 in. by 33 in. by 30 in. This has a total loading of 12 kW. A grill, with two 2-kW sections, and a fish fryer, with two pans, each measuring 36 in. by 18 in. by 8 in., loaded to 3 kW, are also shown. Among the equipment suitable for restaurant cooking installations are a 20-gal. stock pot (5 kW) and a table containing six covered-in hotplates, each of which has an electric lamp in its circuit to indicate whether it is "on" or "off." Domestic cooking (on perhaps a rather large scale) is represented by a "Magnet" double-oven range. Each oven has a cooking space of 24 in. by 22 in. by 34 in., and a loading of 6½ kW. Smaller domestic cookers, kettles, &c., complete the display.

Avamore Engineering Co., Ltd.

A number of electrically-operated machines for the preparation of food are shown by this company. Among these are coffee granulating and pulverising machines, all of which are equipped with a device for freeing the machine from the motor if any obstruction should occur in the grinding process. In the centre of the stand is a "Verto-Jet" dish-washing machine, in which the articles under treatment are carried by a motor-driven belt vertically through the body of the machine, during which time they pass through sprays and a rinsing tank. A bread-cutting and buttering machine is another exhibit. This is driven by a small motor, and has a reciprocating table upon which a loaf is placed and kept in constant position by a feed arrangement. Upon the backward motion of the table the bread passes over a roller, by which it is spread with butter, and it is then cut by a guillotine. Other appliances shown by the firm are a drink mixer, driven by a tiny motor, a knife-cleaning machine, a potato peeler, and refrigerators, all of which are electrically operated.

Artofex Engineering Works, Ltd.

A large electric pastry oven is the main electrical exhibit of this company. The oven has three baking chambers with elements on four sides and "six-heat" controls, and "proving" chambers at top and bottom. Large and small dough mixers with electrically-operated arms are also shown. Another appliance which is on view is a vegetable shredding or scraping machine with an electric motor drive; this is fitted with various kinds of cutters for a number of operations.

National Gas Engine Co., Ltd.

The main exhibit of this company is a heavy oil engine, but in addition there are shown two small generating sets. One of these consists of a vertical petrol-paraffin engine directly coupled to an "E.C.C." generator giving 50 A at from 50 to 70 V. The other comprises a "G.E.C." machine (16 A at 100/140 V), chain driven by a horizontal pattern petrol-paraffin engine.

Imperial Machine Co.

Among the electrically-driven machines exhibited by this company are a silver burnisher suitable for hotels and restaurants, and vegetable paring machines. There are three sizes of the latter, driven by .5, .75, and 1-h.p. motors, respectively.

Staines Kitchen Equipment Co., Ltd.

Examples of "Mannesman" refrigerators are displayed on this stand. The pumping and compressing apparatus of these is operated by a compact magneto generator. Another device shown is a "Tornado" dish-wisher. This has a spiral track arrangement which carries the plates through a bath of soapy water, passes them under a spray, and delivers them on to a table. A Hobart "kitchen aid" is also shown. This little device performs a large number of food-preparing operations. The machine itself consists of a small vertical motor with a "chuck," into which can be inserted an egg beater, a dough hook, or a pastry knife, which work upon food placed in a bowl beneath them. By means of a number of attachments other operations, such as meat mincing, coffee grinding, ice-cream freezing, &c., can be carried out.

Benham & Sons, Ltd.

An interesting appliance shown on this stand is an electric water boiler suitable for use in restaurants. The boiler is equipped with four immersion heaters of the company's standard type, each of which has a fuse contained in a separate box situated near the boiler. The latter has a cast-iron body and an easily-removed front. It is fitted with a safety valve, pressure and water gauges, automatic pressure control gear, and a nickel-plated fountain column with a draw-off cock. The boiler is so designed that only water which is actually boiling is forced up into the column. The "Victor" dish-washing machine, another exhibit, consists of a large galvanised iron (or copper or Monel metal) tank with a circulating water system provided by a double-chamber pump fitted beneath the tank, driven by a 2-h.p. motor. The latter also rotates the spiral rack which carries the dishes, &c., through the machine. The water is heated, as usual, by gas burners in the absence of a direct hot water supply. The machine is stated to have a capacity of 7,500 pieces per hour. Other appliances included in the display are an electric urn (with immersion heater), a large electric toaster, and a towel rail. The last is representative of the firm's "electro-vapour" apparatus, which employs a hot water circulation combined with electric heating.

Refrigerating Machinery.

A number of firms exhibit refrigerating machinery, in addition to those already mentioned. The apparatus shown varies in size from the small set suitable for household use to the very large units employed on meat-transport ships. The firms displaying equipment of this type are:—J. & E. Hall, Ltd., Richard Crittall & Co., the Lightfoot Refrigeration Co., Ltd., the Mechanical Refrigerator Co., H. J. West and Co., Ltd., and Sulzer Bros.

The Model Farm.

This is situated in an annexe, and is devoted to stock-breeding and agricultural exhibits. A number of the buildings were erected by Messrs. Boulton & Paul, Ltd., who have supplied "Electolite" generating plant for the provision of lighting. Apart from this and the illumination of a model farm house, there is nothing electrical in this section, unless we include the radio set, also in the farm house.

Other Exhibitors.

Brief mention must be made of the other firms who show electrical apparatus. These are the Betax Mfg. Co.—vacuum cleaners, violet-ray apparatus, immersion heaters, &c.; Gem Labour Saving Device Co.—"Ohio" electric vacuum cleaners; E. Duncan Doring—electro-mechanical automata for advertising purposes, advertising mirrors, and unbreakable bases fitted for electric lamps; and the Attracta Electrical Co.—"Attracta" advertising signs consisting of continuous bubble streams in glass tubing worked into various designs.

The Insulation of Electrical Machinery.

A Review of Recent Improvements.

By K. G. MAXWELL, M.I.E.E., and ALLAN MONKHOUSE, M.I.E.E.

(Abstract of Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.*)*

THE paper reviews recent developments in the manufacture and use of insulating materials. A survey of the prominent characteristics of such materials is followed by a summary of process improvements, and the authors put forward a strong plea for standardisation of nomenclature and of test methods for determining essential properties of insulating materials. The eight appendixes include a considerable amount of data obtained by test methods as adopted by the Electrical Research Association. The authors compare the better known rating rules, remarking that, so far as Great Britain is concerned, they are only now emerging from the melting-pot. B.E.S.A. specification No. 168 has helped partly to fill a badly-felt need for standard information, but the electrical industry as a whole is awaiting reliable information with regard to the behaviour of insulating materials offered as insulators under the extreme electrical, thermal, and mechanical conditions permissible in electrical machinery and apparatus. It is perhaps reasonable to anticipate that one of the results of the valuable work now being done by the E.R.A. will be to provide the industry with this information. In the preparation of such data ageing and life tests should be considered as of prime importance. The effects of continued exposure to conditions representing operating conditions in machines has only been superficially dealt with in the past. Tests of this nature should include a study of the effects of vibration, moisture, and sustained electrical and mechanical stresses, all at the extreme temperatures likely to occur in practice. In an appendix the authors set forth in tabular form some of the properties of the insulating materials in general use.

Standardised methods of testing cannot be too highly emphasised, and it is to be hoped that the methods recommended by the E.R.A. will rapidly be adopted by all who test insulating materials. So far, however, these test methods are only applicable to raw materials and not as a general rule to finished apparatus. Some definite policy with regard to the latter is very necessary, particularly with respect to the so-called high-pressure or flash tests. Generally accepted practice at present is to apply to insulation a flash test of from 2 to 2½ times nominal full voltage for several minutes while the apparatus is still hot after its initial trial run. At no time in the life of a machine is its insulation so vulnerable as when it has just completed its first temperature run. The windings—particularly end windings—contain certain volatile matter which rapidly dries up in service, but which during an initial six hours' run has just had time to leave the hotter portions of the material and concentrate where the windings are coolest. A flash test then breaks down what is probably a perfectly sound machine, and thus necessitates a "re-wind" where "drying out" is all that is necessary. The Hartshorn* leakage-loss test appears to afford an ideal way of avoiding many unnecessary failures in testing large plant and apparatus.

Recent research has resulted in perfectly definite conclusions being reached as to the relative superiority of various commercial vegetable fibres for electrical work, and also as to the most suitable methods of converting them into boards for the requirements of the industry. The paper shows the average results of a very large number of tests on the behaviour of special papers made from various fibres. The overwhelming superiority of cotton for high-temperature work is clearly demonstrated; the highly lignified fibres, including jute, deteriorate seriously at temperatures over 80 deg. C.

Another most interesting development is the manufacture of pressboards possessing widely differing properties, making them applicable to specific requirements. Finality in this direction has not by any means been reached, and insulators of the pressboard class may ultimately largely replace those belonging to the so-called laminated-paper class.

Speaking generally, the fabrics, tapes, &c., in use are not of high quality, and improvement can hardly be expected until manufacturers in general are prepared to pay the additional price for a superior article. Cotton remains the most important wire-covering material, and it is regrettable that so little has apparently been done to attempt to improve the insulation value of the cotton yarns which are applied to wires. Possibly this is due to the fact that the majority of engineers regard the cotton covering on wires merely as a spacer, and calculate the electric strength of the covering as being that of an equivalent air film. Experiments have clearly shown that this is not the case, and that by paying strict attention to the selection and treatment of the yarns employed, appreciable improvement can be made in electric strength, which is also accompanied by an enormous improvement in insulation resistance. In telephone and similar work this is of prime importance. The authors have recently devoted considerable attention to this problem, and test results on specimens of specially prepared unbleached cloth treated in various ways have clearly indicated the improvement procurable, although they are so far insufficiently conclusive to establish the exact nature of the process to be employed. It would appear, however, that treatment of the cotton yarns and fabrics for a short period in a very weak solution (approximately 0.5 per cent.) of caustic soda followed by washing is all that is required to render a very considerable improvement in the electrical properties of the cotton. In addition, experiments with specially prepared cotton yarns have been carried out, using a subsequent treatment of basic dye and further washing, in collaboration with the British Cotton Industry Research Association. In view of the results it is reasonable to hope that one of the lines along which further industrial research will be directed will be that leading to the commercial application of the improvements indicated above.

Paper-insulated wire is another comparatively recent development with much in its favour, particularly for use on high-pressure transformers immersed in oil, since it can be built up to a considerable thickness very much more readily than the insulation applied in the form of yarn.

The serious disadvantages of asbestos are its capacity for taking up moisture and its liability to contain conducting fibres of magnetite. There is hope that both these shortcomings may be largely remedied by adopting a suitable water-resisting size, and treatment along the lines of the oxalic acid treatment, details of which were originally published in British patent No. 24,259/1911.

There is probably no insulating material which causes its producers so much anxiety in manufacture as the bakelite-paper class. When carefully made by properly and scientifically controlled processes, bakelite-paper products constitute an extremely good Class A insulation, but the popular idea that bakelite-paper products may be used at temperatures up to 160—180 deg. C. without deterioration is erroneous. The paper constituent loses its nature at temperatures of from 100 to 120 deg. C., depending on the raw fibre from which the paper is made. Bakelite asbestos, however, may safely be used up to 150 deg. C. without its strength being impaired. The only serious disadvantage possessed by the better grades is "tracking." When a bakelite material has once been under the influence of any form of disruptive discharge, whether it be a power arc or only a flash over the surface during a pressure test, the path followed by the arc becomes a conducting path even at a comparatively low voltage, and when once started is extremely difficult to eradicate. All organic fibrous materials naturally char in the presence of an arc, but there is an enormous difference in the extent of the damage done. Bakelite-paper materials, unless protected by special varnishes, almost all invariably failed on the first application of the test, whereas all other fibrous insulating boards withstood from six to 20 applications before failure. Vulcanised fibre shows up singularly well in this connection, proving its suitability for use as a fuse carrier. The presence of small quantities of anti-oxygenes prevents auto-oxidation in substances of the phenol and aldehyde groups, and bakelite resins which contain traces of hydro-quinone have shown a marked improvement with regard to the tracking defect.

Shellac-paper products are limited in their use by their tendency to soften at temperatures above 80 deg. C. unless subjected to an extended "curing" treatment. One development, however, has been the application of shellac-treated paper to the manufacture of condenser terminals. This has done much to render possible the manufacture of electrical plant for transmission line pressures up to 220,000 volts, and terminals have already been produced capable of dealing with one million volts; the dimensions of such terminals are in the neighbourhood of 42 in. diameter and of 20 ft. length.

Vulcanised fibre is one of the poorest insulating materials in modern use, but nevertheless it has given most excellent results for many years in a varied number of applications, including rail-joint insulation, fuse holders, slot wedges, packing and spacing blocks, contact carriers on low-pressure switches, &c.

Mica itself does not begin to disintegrate until raised to temperatures well in excess of those encountered in electrical plant, but the bonds used in building it up into micanite, and also the paper and fabric "carriers" frequently employed as a backing for mica, are in most cases affected by temperatures in the neighbourhood of 100 deg. C. The I.E.C. rules permit Class B insulation to contain Class A material for structural purposes only, and specify that only where such material may be destroyed without impairing the insulating or mechanical qualities of the combined material may the latter be considered as Class B insulation. There seems to be some considerable latitude in interpreting this rule, and in a future revision of the B.E.S.A. specification some definite

* *Beama Journal*, 1923, vol. xiii, p. 89.

values should be specified as a minimum for the percentage by volume of truly fireproof material (as, for instance, mica, asbestos, &c.) that a Class B insulation should contain. Micafolium wraps not infrequently contain only 25 per cent. of mica by volume—figures as low as 14 per cent. by volume have been found in wraps made by certain foreign manufacturers—and yet such a wrap is frequently looked upon as Class B insulation. For large machine work a figure in the neighbourhood of from 35 to 40 per cent. of mica by volume in mica-wrapped insulation would probably be a reasonable figure for a Class B insulation.

Much misunderstanding has frequently been caused by the use of percentage-of-mica figures based on weight and not on volume; such figures are very much higher and quite misleading. When expressing percentage-of-mica figures in mica wraps on, for instance, alternator bars, figures by volume higher than 45 per cent. are almost unobtainable commercially, but such figures expressed as a percentage by weight may be from 65 to 75 per cent. of mica, depending on the specific gravities of the paper and bond employed. In micanite plate (in which no fibrous material is employed as a "carrier") it is not difficult to obtain percentages of mica by volume of 85 per cent.

Among the more recent improvements introduced into the building of mica products, the use of machine building should be mentioned. Machine-built micanite is mechanically and electrically superior to that built by hand, even when lower grades of raw splittings are employed, and is cheaper to manufacture. Another important development has been the general introduction of "cushion pressing," *i.e.*, placing a resilient material (such as thin felt or heavy cloth) between the sheets of micanite whilst being pressed. This results in an even distribution of bond and mica and produces beautifully uniform sheets, free from the light patches familiar in micanite made between solid metal platens.

Unfortunately, asbestos papers are generally weak mechanically, and the special treatments so far applied to improve electric strength (for instance, the oxalic acid treatment) by removing the magnetite fibres from the asbestos tend still further to reduce the mechanical strength of the material. It is to be feared that the raw fibre used in paper making is too frequently residue material and contains many impurities. Probably the use of high-quality spinning fibres would go far to remedy this defect without greatly increasing the cost.

Asbestos tapes are being more extensively used in place of cotton tape in coil insulation which is called upon to meet a Class B specification. The chief disadvantage of using such tape at present is the difficulty in securing thin tape. The majority of tapes on the market at anything like a reasonable price vary in average thickness from 12 to 20 mils. The difficulty in making a thinner tape is entirely in the production of fine asbestos yarns without the introduction of cotton. If manufacturers' specifications would permit a comparatively small percentage of cotton (*e.g.*, 10 or 15 per cent.) to be included with the asbestos, tapes could be produced down to average thicknesses of from 7 to 8 mils.

With the increase of high-pressure work, porcelain is becoming the centre of much attention, and extensive research work is now in hand with a view to improving this material, both on the Continent and in the United States. British manufacturers do not seem to have devoted the same attention to the scientific development of electrical porcelain, involving, as it does, a complete study of the clays utilised, grain size, blending, and of the problems of close temperature control during firing. It is to be hoped that the conservative attitude of those in charge of this particular industry will not exclude British products from the high-grade electrical porcelain market of the future.

The development of outdoor apparatus, particularly in connection with outdoor sub-station work, has called for special insulating varnishes, capable of protecting organic insulation against extreme weather conditions. No generally accepted practice in this connection is evident at the moment; the paper contains figures indicating the relative protecting power of various classes of varnish.

The B.E.S.A. standard (specification 148) sludge test is unquestionably good, but needs extremely careful handling to obtain consistent results, and it takes 48 hours to complete. Such a long period is frequently extremely inconvenient in actual practice, and to obviate this difficulty a very simple and apparently reliable method has recently been suggested by Mr. W. H. Nuttall.* The various properties of insulating oils commonly in use are set forth in an appendix to the paper. With reference to the electric strength, although B.E.S.A. specification 148 definitely lays down that the electrodes should be horizontally arranged, recent research has quite definitely established that with oils of the purity referred to in that specification, where all other conditions are equal, the question whether a horizontal or a vertical arrangement is employed affects the test results to an absolutely negligible extent.

It is not generally realised what a large number of different materials are available under the heading of bitumens, using the word in its widest chemical sense. An appendix indicates the wide field covered by this group, showing electrical properties where they apply. Many of the materials possess extremely satisfactory electrical characteristics, whereas others are far from satisfactory. There is little doubt that the practice of regarding materials which have a black bituminous appearance as bitumen has resulted in much trouble to electrical engineers in the past.

Rubber latex for improving papers and pressboards is not recommended, since the paper in which it is incorporated unquestionably ages rapidly at temperatures exceeding 80 deg. C. The past four years have witnessed considerable progress in the improvement of insulating processes employed in manufacturing electrical machinery.

Manufacturers have at last appreciated that the majority of insulating processes are specialised operations requiring suitably designed machinery, and that the struggle to perform these difficult operations with machine tools constructed for other purposes very seldom pays in the long run. The number of firms now specialising in the manufacture of machinery for insulation work bears ample testimony to the truth of the latter assertion.

Great improvements have recently been made in baking and drying equipment. The scientific principles of the quick removal of moisture during drying, and quick oxidation of varnish during baking, have been closely studied, and the ovens modified accordingly. In many factories the "through" type of oven is in use, ensuring a definite and gradual rise of temperature as the parts pass through on a conveyor until a maximum is reached, followed by a gradual reduction of temperature before removal. Thermostatic control and temperature recorders are almost everywhere employed, since so much depends upon a close adherence to times and temperatures in baking insulating materials. Air circulation has been greatly improved in modern oven designs. The bad effect of "stewing" varnished products in their own varnish fumes have been realised by all, and the totally enclosed oven is a thing of the past. Electric heating of the air supplied to baking ovens is employed to a limited extent. The recovery of the solvents from drying ovens is hardly practicable except in specialised factories.

A special application of baking processes is the so-called bakelisation of synthetic resin products. According to the original ideas of treating the products, the final condensation process was carried out by baking at 150 deg. C. in strong steel vessels under 120-160 lb./sq. in. pressure of air. Such high temperature and high pressure baking is quite unnecessary. With recent phenol-aldehyde varnishes bakelisation can be produced equally well with a prolonged baking of 40 to 60 hours at 115 deg. C. to 120 deg. C., which is a temperature far less likely to do any permanent damage to the organic constituents of the insulation.

Probably more insulation failures are due to careless handling and damage in transport than to any other cause, and practice has shown that the provision of special bogies and transport facilities usually more than compensates for their initial cost and upkeep.

Cases are cited of the necessity for the strictest control of every detail in the process of insulating modern equipment, and a sample process specification which takes the form of detail shop instructions covering all essential shop points upon which the successful manipulation of the material may depend is given in an appendix.

Modern firms have proved the necessity of adopting a definite scheme of training operatives, including both the manual training of apprentices by means of instructors and the special training of operators on all machines where the technical significance of each operation is of importance. In addition, modern practice calls for the development and training of specialists qualified to undertake investigational work into shop problems, design features and test-bed methods.

In conclusion, the authors' experience is that such improvements in the insulation of electrical machinery as have been effected of recent years, have arisen from experience gained through either deliberate development or the intelligent observation and study of defects. A strong plea is made for the complete classification of insulation materials and methods of testing them, and also for closer co-operation between users and manufacturers of electrical plant, so that a study of present-day requirements may lead to developments in method and material, and permit of full investigation into service and ageing effects as well as into failures that occur.

Discussion in London.

Mr. E. B. WEDMORE opened the discussion by remarking that that kind of paper would always be welcome; it represented a great deal of work, and was in the nature of a land-mark. Much progress had been made recently, but the experiments described bordered on empirical engineering methods. Although he did not decry such methods, they did not lead very far; for instance, the fuse tests described in the paper indicated nothing beyond what actually happened during the test, and so could not bring about improvement. He insisted upon fundamental research because they could not afford to wait too long for results. Such work was very costly, and therefore only very large firms could undertake it. Some questioned the value of purely scientific work in that way, but there was a great lack of knowledge of the phenomena they were constantly encountering. It was easy to throw out a bad sample as such, in order not to hinder production, but such a procedure was not enough. In the calmer atmosphere of the Research Association they could turn such things over in their minds. There was a great lack of fundamental data. Foreign readers of the paper might gain

* *World Power*, 1924, Vol. II, p. 92.

a wrong impression from certain statements, and it would therefore be advisable for the authors to modify some of their remarks before final publication.

Mr. J. ROSEN agreed with the previous speaker as to the necessity for some of the wording of the paper to be modified. He referred to the desirability of carrying out tests to determine the shrinkage, or powdering, of insulation after use. It was difficult to obtain standard mica splittings, and bakelite papers were unsatisfactory at high temperatures. It was important to test all samples of asbestos on receipt, because they contained many impurities.

Mr. A. R. DUNTON pointed out that bakelite was used in many cases under quite unsuitable conditions. A varnish film should be applied to protect it against moisture, and very excellent results could be obtained with it if used in the proper manner. Bakelising could be properly done if the materials used in the process were taken at their proper stages. There were many controversial points in the paper.

Mr. A. COLLINS said that users of bakelite products could not hope to compete in their manufacture with specialists in such insulating materials. Their production necessitated highly technical supervision, and he protested against the authors' statement that no other material "causes its producers so much anxiety in manufacture." Concerning the statements that flash tests damaged bakelite paper insulation, it was a question of how much power was used, and the authors' illustrations indicated that very severe tests had been used in order to obtain results quickly. In the production of micanite for commutators, the tolerances allowed were small, but he maintained that makers could keep within the limits.

Mr. H. C. SILVER congratulated the authors on obtaining such very consistent results in their Table I, but he would have felt happier in drawing conclusions if the tests had been carried out in air. Regarding the relative merits of papers, the authors' tabulation might have been modified if the tests had been carried out in air, and he thought a stage had now been reached when improvements could be made by other than technical processes. He understood that bleached papers were likely to give better results, because paper manufacturers took more trouble in producing such papers. It should be understood that higher prices would have to be paid for better materials.

Mr. W. P. DIGBY thought that in the appendix on terminology some of the suggested names were not a happy choice, but the sooner they had such a standard list the better it would be. Regarding testing, besides output and temperature, the speed of the machine should also be taken into account, because slot area had an effect on the insulation of high- and low-speed machines. The best place for pressure tests to be made was in the makers' works. Some of the authors' remarks on the manufacture of porcelain should be revised. In some cases certainly there was a deficiency of high-pressure testing apparatus, but, generally, porcelain manufacturers were aware of the conditions and tried to meet them. With regard to the use of moulded mica, they were far ahead of Continental practice, and were at least equal in the use of woven fabric. The life history of a machine was of great value in determining the suitability of the insulating material, but he was afraid that some of them might die of old age before they discovered weaknesses in good British insulation.

Mr. H. D. SYMONDS said that some of the previous speakers had already covered points he had wished to make. He supported the plea for standard nomenclature, but suggested that numbers should be used instead of names, in order to avoid such terms as "special super bond paper." He did not share the authors' enthusiasm for boiling cotton in caustic soda. Very little different results were obtained when it was boiled in water only. He agreed with the authors' remarks as to the weight-volume percentage of mica definitions. He supported those who advocated hot dipping instead of vacuum impregnating. The latter, he thought, was the biggest bit of bluff the industry had known, and the former was much cheaper. He would advocate the use of baking in excess even of that suggested by the authors; the materials would stand it with benefit. The employment of skilled operatives was the secret of success, because everything depended on intelligent selection and treatment of materials.

Mr. W. J. JOHN protested against the authors' remarks regarding porcelain manufacturers. The statement that they were conservative and lagged behind foreign manufacturers should certainly be modified. They were fully alive to the value of research, and they were not hampered by lack of extensive high-pressure testing plant. One firm alone had spent £20,000 on such plant in the last two or three years.

Capt. P. DUNSHEATH, O.B.E., remarked that much work was being done, but little was being written on the subject of insulation. With regard to the characteristics of cotton-base papers, shown in the authors' Table I, the tests on chemical wood and manilla confirmed his own results, and yet many engineers thought that manilla was better than wood pulp. Had, therefore, some factor been overlooked, and did the order of materials in Table I merely indicate the ease with which fibres became impregnated? Table III did need criticism. Dielectric resistance should be determined in the dry or impregnated state. He regretted that the authors had dismissed the theory of dielectrics in so few lines. They might have written a little more for the benefit of fellow workers.

Mr. A. MONKHOUSE, in reply, agreed as to the empirical nature of the works tests described, but manufacturers, he said, were looking to Mr. Wedmore's association to make those tests more scientific, but at the same time no more difficult to carry out in works laboratories. The theory of the subject deserved a paper of its own, and he hoped to see such a paper given an evening to itself. The list of names of materials in the paper had not been put forward as a suggested standard—it had been drawn up for use in the works, and could be improved, of course, but he did not agree with the suggested use of numbers in place of names, although names should be chosen so as to avoid the use of trade names. The tests indicated in Table I had been carried out in oil, advisedly. The length of time the samples remained in the oil before the tests were made made an appreciable difference, as Capt. Dunsheath had suggested, and the samples had remained in the oil for 24 hours before being tested. Boiling cotton in water would probably give as good results as boiling in caustic soda, but the point was that the cotton used for wire insulation was practically in the same state as when it left the tree; it was not treated as cloth was. Expansion and contraction troubles, specially in long-rotor machines, were very real, but they had practically been overcome by modern methods of manufacture and proper control of materials. His considered opinion was that Britain led the world in insulating practice, but they must not be content with that, and in order to continue to lead much research was needed in the porcelain industry.

An E.H.P. Transmission Cable.

PARTICULARS of the design, manufacture, and installation of a new e.h.p. cable are given in an article by Mr. Philip Torchio in the *Electrical World*. This cable, which is being used experimentally on a 90-mile line of the Societa Interregionale in Italy for transmission at 130,000 V, leads us into a new field of

Fig. 1.—Joint Construction on Hollow-Core Cable.

cable construction. The cable is made up of a certain number of copper wires stranded around an iron-wire spiral which leaves a hollow core. The insulating paper is wrapped around the copper wires in the normal way and is covered with lead, after which a protecting layer of paper and tarred jute is applied. The impregnation of the paper is done after the lead has been applied. The moisture is removed by a current of dry air sent through the hollow core; then a vacuum is

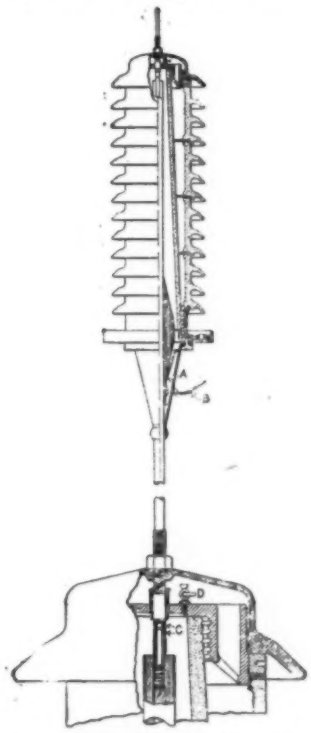


Fig. 2.—Construction of End-Connection for 130,000-V Cable.

Fig. 3.—Section and Elevation of the Pirelli E.H.P. Cable.

created, after which a fluid compound is allowed to flow in. The hollow-core construction supplies the means for filling up the empty spaces which are formed every time that the cable goes through a certain temperature cycle, maintaining always perfect impregnation of the dielectric. Jointing on this cable is

somewhat simplified by the hollow core construction. The copper wires are soldered to each end of a copper sleeve which supplies the continuity of the hollow core, and insulation is built up around the copper sleeve by the splicing method. The perfect impregnation obtained permits the keeping of the diameter of the lead sleeve down to a size slightly larger than that of the cable. Fig. 1 shows the construction of a joint of this cable.

The greatest difficulties in connection with this cable are presented in providing terminals for operating on such high pressure. The first difficulty, that of overcoming the tangential dielectric stresses which are formed at the point where the lead terminates, is met by the provision of a special metal shield devised to keep these stresses within certain limits until sufficient thickness of insulation has been built up around the conductor. The next difficulty, that of making the terminal end or pothead oil-tight, is overcome by making the pothead in two parts, one inside the other, and filling the inner, which connects with the oil tank, with the cable oil compound and the outer with a solid compound. Fig. 2, an illustration of a pothead for use with this h.p. cable, shows (*a*) the electrostatic shield, (*b*) the oil intake, (*c*) the openings for the oil, and (*d*) the cock for discharging the gases. After the laying and jointing of the cables are finished, the vacuum is applied, and a load is put on the cable to facilitate the drying, after which the cable is filled with the compound. Special oil tanks are placed a few feet above the highest point of the cable, thus maintaining the cable thoroughly impregnated at all times; the tanks are made moisture-proof in a way similar to that adopted for transformers.

Factory tests have been made on the cable installed. Each length of cable was tested between conductor and lead as follows:—150,000 V for 15 min., 175,000 V for 1 min., and 200,000 V for 1 min. One length of cable was tested at 275,000 V for 2 min., and 150,000 V for 24 hours. Similar tests have been made on the potheads. The cable was in use from March to May, 1924, at 65,000 V, and since October, 1924, it has been operating at 130,000 V with unearthed neutral. Fig. 3 illustrates the construction of this cable, manufactured by the Pirelli Company.

A New Industrial Institute.

WE have received a number of printed and other documents giving particulars of the Industrial Institute which has been formed for the study of the fundamental problems of industry. Its offices are at 102, Belgrave Road, London, S.W.1, and Mr. Norman Wyld (formerly responsible for the affairs of the Society of Technical Engineers) is its director. We give below a note of the objects of the Institute, and reference is made to the matter in our leading columns to-day. Those who are interested in the movement can obtain printed particulars from Mr. Wyld at the above address. The prospectus gives lengthy lists of vice-presidents and members of Council. Members of the Institute will pay a yearly subscription of one guinea.

Objects.

(*a*) *Association.*—To associate and unite those interested in questions of industrial relations, more especially those performing responsible duties in connection with production, distribution, and finance, by means of the scientific study of those industrial questions which are of such importance in this age and tend to divide men into opposing camps to the detriment of the nation and of every individual. The Institute will not be concerned to maintain private ownership, nor to develop public ownership. Its object is to study things as they are, and by the light of knowledge so gained to form conclusions which may be put into practice and tend towards improvement of the conditions of industrial life.

(*b*) *Relation between Science and Practice.*—To secure that the governing body of the Institute shall be so constituted and contain men of such position and experience in the worlds of affairs and of science that effective relations will be established between the two and, thereby, that the problems submitted to scientific research will include those which emerge in the actual conduct of affairs, that data collected for business may become available for science, that the results of research may be revised in the light of practical experience and be given authoritative expression, with effective publicity, and thus become available for practical use, so that both science and practice may be advanced.

(*c*) *Science.*—To develop a descriptive science of the present working of the industrial system, including production, distribution, and finance, especially from the point of view of the human relations and ethical considerations involved, and to strengthen the foundations of the science of industrial ethics.

(*d*) *Research.*—To promote scientific research into those questions of industrial economics and industrial ethics which touch the relations and interests of the groups into which the development of the industrial system has divided the nation.

(*e*) *Bureau of Information.*—To organise a clearing-house for the collection and diffusion of information on all questions of industrial relations.

(*f*) *Publication.*—To arrange for the publication of papers, without prejudice, on all sides of any question of industrial relations, and for the discussion of such papers, and to issue from time to time, under its own authority, summary statements of its own conclusions in regard to any such question.

(*g*) *Analysis of Legislative Proposals.*—To examine legislative and other proposals affecting industrial relations, to prepare detailed analyses of them, and to publish reasoned statements of their probable effects.

(*h*) *Relations with other Bodies.*—To enter into such relations with other organisations having allied interests as may be found desirable and practicable.

(*i*) *Funds.*—To acquire and employ funds and/or other property and to employ such funds and/or property for the above objects and to acquire, lease or build premises for the purposes of the Institute.

A Memorandum.

A memorandum has been prepared by a group of members as a guide to the Council as to the direction to be taken in its deliberations. This suggests an inquiry into the possibilities of "balanced industrial development." It commences by stating that the Institute conceives of industry as a three-fold process, namely, making, marketing, and financing. The most fundamental of all the problems of industry is the question of how it may be conducted so that the employment of our people may be less subject to interruption. Any steps which are taken in this direction will also tend to decrease production costs, stimulate the demand for goods, and reduce the tendency towards the restriction of output. Periods of trade depression are wasteful in proportion to their magnitude. It is true that during the last 30 years, probably partly due to the improvement of international communication, these fluctuations have tended to become less violent. The pre-war adoption of the gold standard by the chief industrial countries also led to greater stability by giving the central banking authorities greater control of industrial conditions. There is a need for some authoritative central clearing house for the co-ordination of industrial and financial studies and of their results. Irregularities in the demand for goods and the consequent irregularities in the rate of production, associated with "trade cycles," lead to wide variations in selling prices which are not always in accord with the variations in the cost of production. Attempts to avoid the consequences of these movements often result in the limitation of output by manufacturers. For a different reason, the terror of unemployment, the workers are also tempted to restrict their output. Any steps leading to the cessation or reduction of these restrictive actions would be of material advantage. Another question to be studied is the development of industry to absorb the ever-growing number of workers. Industry is able to develop by reason of the investment of savings. Before the war it was estimated that the savings of this country were of the order of £1,000,000 a day; at present they should be well over £1,500,000 daily, if they are in the same proportion to income as before the war. In 1924 the new capital raised was estimated at £223,000,000. There is reason to believe that our national annual savings should be, theoretically, sufficient to employ the annual increase of our population. The direction of the flow of investment is determined by the security of the proposed investments and the return which may be anticipated from them. Responsible men of affairs reject any suggestion that considerations other than those of security and return should be taken into account in determining the investments to which national resources should be directed. Of recent months, however, financial authorities have suggested that in directing the flow of investment consideration should be given to the special problem of unemployment, with a view to developing those industries which can add, quickly, to employment. Operations of this order may produce results out of all proportion to the amount of capital so employed. This problem of so directing capital to decrease unemployment, whether it is immediately remunerative or not, is the chief question to be considered. Is it not possible that the Institute might, with advantage, accept as a principle the idea that the fundamental essential of industrial development is that it should, as far as possible, be associated with the regularity of employment for our people? There are already tendencies in this direction, *e.g.* the gradual merging of small unco-ordinated organisations into larger bodies. Inquiries into the possibilities of co-ordinated action as between manufacturers and distributors should yield valuable results. In pursuing its inquiries the Institute will have to take into consideration our trade with the Dominions and the rest of the world.

The gist of the suggestion is that the stabilisation of industry and employment is the main objective of all. The attitude of mind adopted should be one of inquiry, and this should be conducted on scientific lines.

Giant 118,800-Volt Transformers.

Ferranti 120,000-kVA Plant for India.

In the spring of 1924 Messrs. Ferranti, Ltd., secured an order for four 30,000-kVA (B.E.S.A. rating 46,500 kVA), 118,800-V, three-phase transformer groups for the Tata Power Co., Ltd., of India.

This order is of special interest inasmuch as it affords evidence of the progress made by the electrical manufacturing industry in this country. Hitherto orders for electrical plant for this and many similar undertakings were generally given to foreign firms which had benefited by experience gained on similar plant for their own countries, whereas during the last year or two British engineers have demonstrated that they are capable of meeting any demand for electrical plant of the largest size and for the highest pressure.

The transformer groups in question are said to be the largest yet made in this country, and another point of significance is the fact that the purchasing engineer practically confined the stipulations of his specification to the performance of the transformers, thus allowing the manufacturer to use his skill and experience to the greatest advantage in meeting the specified requirements—a practice worthy of imitation, for it is important that British manufacturers should be unhampered by unnecessary restrictions that tend to impede progress and to standardise a Home type of product which is too expensive for use abroad.

The transformers form part of a scheme for transmitting hydro-electric power at extra high pressure to Bombay by an overhead transmission line 70 miles long. Each 30,000-kVA group consists of three 10,000-kVA single-phase transformers connected delta-star, 11,000/118,800 volts, 50 periods, with the neutral point permanently earthed. They are of the oil-immersed type, the cooling oil being circulated by electrically-driven pumps through the transformers and through separate water-tube coolers.

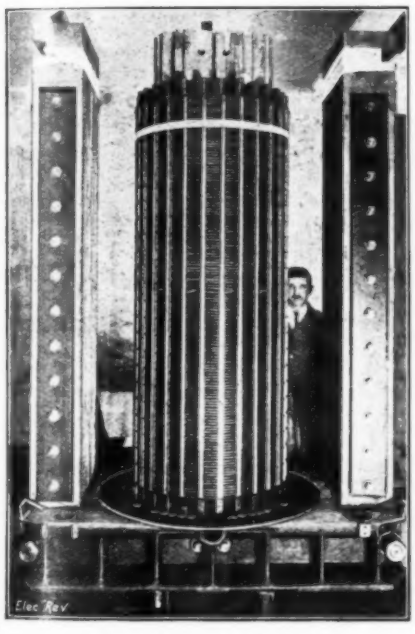


Fig. 1.—Core and L.P. Winding.

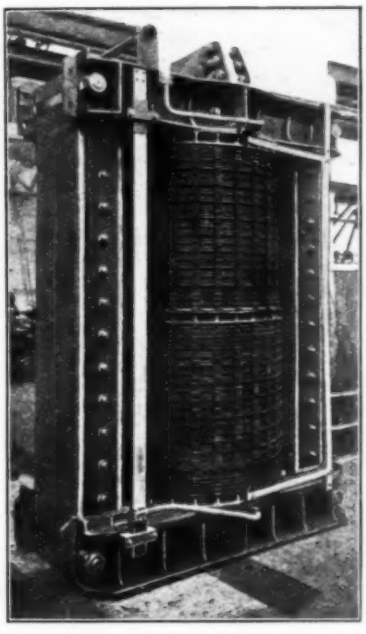


Fig. 2.—H.P. Winding and L.P. Connection.

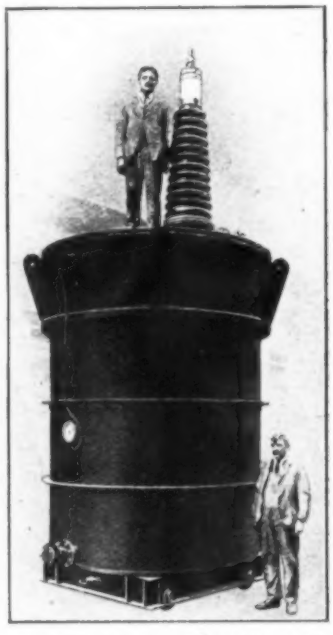


Fig. 3.—Single-Phase 10,000-kVA Unit.

A conservator vessel is provided for each group of transformers to maintain a head of oil above the top of the tanks, and to reduce the surface of oil in contact with the atmosphere. Air is admitted and emitted through Ferranti oil-sealed calcium chloride breathers, which extract moisture from the internal air, the carbide being protected from moisture in the external air.

Provision is made for filtering the oil on site, and each transformer is fitted with a dial thermometer provided with alarm contacts. A set of cooling gear is provided for each group, but each set can cool the oil of two groups if required. Indicators in the oil pipes show the flow of oil.

In the form of core construction employed, the laminations of transformer steel are interlocked at the corners by square steel bolts; thus the steelwork not employed magnetically is reduced to a minimum without any sacrifice of mechanical strength, see fig. 1, which also shows the l.p. coils in position. The Ferranti spring-coil clamps, fig. 2, inserted midway in the h.p. windings prevent any slackness of the coils through shrinkage, and obviate the application of excessive pressure in assembling, or during service, due to thermal expansion. The h.p. terminal bushings are of the porcelain oil-filled type, as shown in fig. 3.

The transformers are designed for a temperature rise of 60 deg. F. (33.3 deg. C.), measured by resistance, above cooling water at 75 deg. F. (24 deg. C.), and the weight of each transformer when filled with oil is 33½ tons.

Legal.

Weber v. Birkett.

This case came before the Court of Appeal, consisting of Lords Justices Bankes, Scrutton, and Atkin, on April 21st, upon the appeal of the defendant (the borough electrical engineer of Southend) against the decision of the Lord Chief Justice ordering a new trial. The original action and subsequent proceedings were reported in our issues of February 6th (p. 213), March 13th (p. 408), April 3rd (p. 531), and April 10th (p. 570). The jury awarded the plaintiff, Councillor W. V. Weber, the sum of £200, but could not allocate this amount as between the two issues of libel and slander. The defendant had previously paid 200 guineas into Court.

Without hearing counsel for the respondent their Lordships unanimously dismissed the appeal, holding that there was no verdict.

British Thomson-Houston Co., Ltd., v. Kremensky & Horn.

This case came before the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Warrington and Sargant, on April 21st, upon the appeal of the defendants from an order of Mr. Justice Eve in the Chancery Division.

Mr. Spencer, K.C., in support of the appeal, said that he wished to raise a rather curious point. In the action before Mr. Justice Eve an order had been made for an injunction restraining both defendants from infringing the plaintiffs' patent granted in 1909, known as the "drawn tungsten wire" patent, for delivery up of all the alleged infringing articles, and for an inquiry as to damages. Since the judgment in the action the plaintiffs' patent had been declared by the House of Lords to be invalid. The writ in the action before the Court was issued on January 17th, 1923, and in the statement of claim there was an allegation that the plaintiffs' patent was valid. The defendants (the appellants) did not plead invalidity but they denied infringement. In November and December, 1923, the question of the validity of the plaintiffs' patent came into question in the case of the British Thomson-Houston Company against the British Insulated and Helsby Cables, Ltd. That case came before Mr. Justice Russell for trial and on January 28th, 1924, that learned judge gave judgment upholding the validity of the plaintiffs' patent. In February, 1924, Mr. Kremensky, in view of this, instructed his solicitor to take no further steps and later his solicitor fell ill and subsequently died. In April the Helsby action came on for hearing in the Court of Appeal, and the defendants when the present case came up for hearing did not instruct counsel to appear and judgment went for the plaintiffs, the British Thomson-Houston Company, by default. On June 2nd, 1924, the Court of Appeal allowed the appeal of the Helsby Company and declared the British Thomson-Houston Company's patent of 1909 to be invalid, and subsequently the House of Lords affirmed that decision of the Court of Appeal. On July 2nd, 1924, the present appellants gave notice of appeal from the judgment of Mr. Justice Eve, and on July 5th defendants gave notice of motion before Mr. Justice Eve to set aside the judgment. When that motion came before the Judge he refused to set aside the judgment. Mr. Spence contended that in the circumstances the order of Mr. Justice Eve should be set aside or varied.

Mr. Trevor Watson, for the respondents, said that his clients would give an undertaking not to proceed under the

judgment, although he contended that they had a legal right to do so.

After hearing lengthy legal arguments by Counsel for the respective parties, their Lordships made an order that the appellants should pay the costs of the action before Mr. Justice Eve, that there should be no order as to the costs of the appeal, that the costs of the application to stay proceedings on October 8th, 1924, should be the appellants', that there should be no order for the costs of an application by the respondent company for security for the costs of the present appeal, and that there should be a set-off as to the costs.

Geoghegan v. J. L. Pulvermacher & Co., Ltd.

ON April 21st, in the Mayor's and City of London Court, Patrick Geoghegan, masseur, sued the defendants, medical electricians, for £11 15s. 6d., which, he stated, had been paid for a twelve-lamp radiant heat bath, whereas the defendants had supplied a six-lamp bath. Defendants maintained that the bath was as ordered, but Judge Shewell Cooper found for plaintiff for the amount claimed and costs.

Southport Corporation v. The Birkdale District Electric Supply Co., Ltd.

IN the Court of Appeal, before the Master of the Rolls and Lords Justices Warrington and Sargant, on April 24th, this case was heard upon the appeal of the Southport Corporation from a judgment of Mr. Justice Astbury in the Chancery Division (*vide* ELEC REV., November 14th, p. 759, and 21st, p. 773, 1924).

The Corporation brought the action against the defendant company for an injunction to restrain the company from charging the Corporation or any other private consumer any price for electrical energy exceeding the price for the time being charged by the Corporation for a similar supply within the area which, on December 31st, 1901, constituted the borough of Southport, or from otherwise committing a breach of the provision contained in clause 4 of a supplemental indenture dated December 31st, 1901, made between the Birkdale Urban District Council and the defendant company.

Mr. Justice ASTBURY upheld the main contention of the defendants that the agreement set up by the Corporation was one which in circumstances that might arise would be incompatible with the discharge by the defendants of their statutory duties. He accordingly held that the action failed and must be dismissed with costs. From this result the Southport Corporation now appealed.

Mr. Greene, K.C., and Mr. Bischoff appeared for the appellants, and Mr. Clauson, K.C., and Mr. Guest Matthews represented the respondents.

Mr. GREENE said that the result of dividing the borough of Southport into two parts, as the company sought to do, was that the old portion of Southport enjoyed certain rates for the supply of electrical energy, while the other portion—Birkdale—was charged at a higher rate. It had been held that in conceivable circumstances not yet specified, the effect of the limitation of price in Birkdale might be to cause the company to go out of business, and as the contract might tend in that direction, it was *ultra vires*. Counsel then proceeded to show what the profit balances of the Birkdale Company were and said that in 1920 they were £7,260, in 1921 £7,210, in 1922 £9,475, and in 1923 £11,086. He said that the figures were increasing each year and the witnesses for the company said expressly that they did not pretend that the company was in a state of financial decrepitude. Mr. Clauson said that they did now.

The hearing was adjourned.

British Thomson-Houston Co., Ltd., v. Commercial Electric Co., Ltd.

MR. TREVOR WATSON, on behalf of the plaintiffs in this case, announced to Mr. Justice Tomlin in the Chancery Division, on April 24th, that they had discontinued their action against the Commercial Electric Co., Ltd., which was in his Lordship's list. He said it was brought on the drawn-wire patent which had been declared invalid by the House of Lords, and the plaintiffs could not possibly succeed. The defendants, early in the proceedings, undertook not to sell any lamps other than those containing Helsby wire, and defendants asked for an inquiry as to what damage they had suffered because of that undertaking.

His LORDSHIP said the action must be stayed and not discontinued, for the purpose of this inquiry, and there must be orders to this effect and for the payment of the defendants' costs, reserving the costs of the inquiry, with liberty to apply.

S. G. Brown, Ltd., v. W. H. Porter & Co.

BEFORE Mr. Justice Eve in the Chancery Division, on April 24th, Mr. ROOPE REEVE, K.C., on behalf of the plaintiffs, moved for an injunction to restrain W. H. Porter & Co., Birmingham, from using the name "Brown" in connection with radio apparatus, and headphones in particular. Counsel said the plaintiffs were pioneers in the radio world and they carried on a very extensive business in the manufacture of apparatus. Early this year the defendants advertised a line of foreign headphones as "Brown's Lightweight (Continental) Headphones." The plaintiffs made a particular line of headphone of a light weight called "Brown's Featherweight." There was no question here of "passing off" and his lordship had not to deal with "make up." The simple question was whether the defendants were entitled to call something by the name of "Brown" which was not Brown's. People might be led to think that the 'phones were the English Brown's at a reduced price.

Mr. ROBERTSON (for the defendants) said he had affidavits in reply, but he offered to put an end to the matter by submitting to a perpetual injunction in terms of the notice of motion if nothing was said about costs. Otherwise he offered an undertaking in the same terms until the trial of the action.

Mr. REEVE said he could not accept the first offer.

His LORDSHIP said that in this case there would be an undertaking in terms of the notice of motion until the trial, and the costs would be costs in the action.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

24,510. "Starters for electric motors." Bayerische Elektrizitäts-Industrie Rott & Co. October 2nd, 1923. (204,726.)

27,690. "Electrically-driven jacks for raising and lowering dental, barber, and surgical chairs or operating-tables, and for like purposes." E. B. Willford. November 3rd, 1923. (231,546.)

27,853. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 6th, 1923. (231,548.)

27,913. "Telephone system using automatic switches or their equivalent." R. Mercer and Automatic Telephone Manufacturing Co., Ltd. November 6th, 1923. (231,549.)

30,183. "Acoustic devices." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 30th, 1923. (231,556.)

32,080. "Electric relays." F. Barrell, C. Ryder, T. W. Ross, and Metropolitan-Vickers Electrical Co., Ltd. December 21st, 1923. (231,565.)

32,267. "Locomotives and other vehicles having combined internal-combustion and electric propulsion systems." B. E. D. Kilburn (Sulzer Frères Soc. Anon.). December 27th, 1923. (Convention date not granted.) (209,090.)

1924.

49. "Thermionic vacuum tubes or valves." C. Seymour and H. G. Hughes. January 1st, 1924. (231,580.)

131. "Coupling devices in or relating to low-frequency amplification circuits." L. W. MacGregor. January 3rd, 1924. (231,582.)

274. "Devices for controlling the speed of direct-current electric motors, driving pumps, fans, blowers, compressors, or the like." Drysdale & Co., Ltd., and J. W. W. Drysdale. January 4th, 1924. (231,588.)

752. "Explosion-proof closures for electrical apparatus." A. West & Co., Ltd., and A. West. January 10th, 1924. (231,600.)

1,867. "Motor-car electric head-lamps and the like." J. H. Asdell. January 23rd, 1924. (231,613.)

2,975. "Crystal detectors for wireless." C. Cox. February 5th, 1924. (231,618.)

4,641. "Machines and processes for electrically seam-brazing or welding together strips of material." G. Warwick. February 23rd, 1924. (231,636.)

4,669. "Electric arc lamps and light condensers." H. D. Taylor. February 23rd, 1924. (231,637.)

5,417. "Synchronous electric machines." C. Shenfer and English Electric Co., Ltd. March 3rd, 1924. (231,642.)

5,506. "Headgear for telephone receivers." H. D. Jackson, Buckle Co., Ltd., and H. D. Jackson. March 4th, 1924. (231,643.)

6,114. "Variable electric condensers." C. I. Taylor. March 10th, 1924. (231,649.)

8,549. "Method of transmitting signals to travelling trains by means of electromagnetic waves." H. Geweeke. April 6th, 1923. (213,921.)

9,662. "Electromagnetic relays." M. B. Richter. April 16th, 1924. (231,676.)

9,781. "Electric switches." Siemens Bros. & Co., Ltd., and H. G. Wood. April 17th, 1924. (231,679.)

10,106. "Electric transformers." S. A. Stigant, H. M. Lacey, and Johnson & Phillips, Ltd. April 23rd, 1924. (231,680.)

14,442. "Electrically-propelled locomotives." Edison Accumulators, Ltd., and J. F. Monnot. June 14th, 1924. (231,705.)

14,643. "Electric starters for internal-combustion engines." "Trib" Maschinen Ges. June 21st, 1923. (217,902.)

15,332. "Electrical measuring or indicating instruments." G. Wall and Metropolitan-Vickers Electrical Co., Ltd. June 25th, 1924. (231,712.)

15,369. "Crystal detectors for wireless signals." Rodo Patents, Ltd., and F. A. L. Sloot. June 25th, 1924. (231,713.)

15,994. "Electric fuse cartridges." Siemens-Schuckertwerke Ges. November 8th, 1923. (224,501.)

16,596. "Means for obtaining inert atmospheres." Metropolitan-Vickers Electrical Co., Ltd. July 20th, 1923. (219,308.)

17,066. "Control apparatus for electric ship propulsion." British Thomson-Houston Co., Ltd. July 26th, 1923. (219,682.)

17,334. "Electric cable terminals for telephone and like cables." Western Electric Co., Ltd. (Western Electric Co. Inc.). July 19th, 1924. (231,721.)

18,053. "Track and wheel brake devices for tramcars and other rail vehicles." R. Burns, jun. July 29th, 1924. (231,729.)

18,911. "Oil-break switches." Sachsenwerk Licht-und Kraft Akt. Ges. October 8th, 1923. (223,196.)

19,827. "Crystal detectors for wireless reception." Hofmann Akt. Ges. fur Elektro-Technik-Medizin-Optik, F. February 5th, 1924. (228,850.)

20,534. "Electric fires." H. H. Berry. August 30th, 1924. (231,743.)

22,321. "Receiving systems for electric signals." Metropolitan-Vickers Electrical Co., Ltd. September 20th, 1923. (222,150.)

23,124. "Thermostatic switches and the like." Robeson Rochester Corporation. October 4th, 1924. (222,869.)

23,205. "Combined electric cigar-lighter and advertising or displaying apparatus." A. Scagnolari. March 17th, 1924. (230,781.)

23,952. "Means for sending into an electric circuit intermittent currents always of equal duration separated by periods of interruption of current of the same duration." Favarger & Cie. Soc. Anon. November 12th, 1923. (224,872.)

24,212. "Electric switching means for indicating electrical overloads." J. Samper. October 13th, 1924. (231,765.)

29,018. "Electric light shade-holders." K. Matsumoto. December 3rd, 1924. (231,783.)

30,411. "Electric gas purifiers." E. Oppen. December 18th, 1924. (231,786.)

1925.

5,507. "Telephone systems using automatic switches or their equivalent." Automatic Telephone Manufacturing Co., Ltd., and R. Mercer. November 6th, 1923. (Divided application on 231,549.) (231,796.)

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